AGRICULTURAL CHEMICALS

New Trends in Custom Dusting

on page 18 this issue

THE RAT MARKET ...and your sales opportunity with ANTU

There is one rat for nearly every man, woman and child in the United States—an estimated 137,000,000 rats.

Rats cost this country an appalling sum every year—about $400,000,000—as estimated by one Government Service.

They compete with man for food, carry diseases transmissible to him, destroy or undermine his buildings, cut his electrical insulation, damage his property.

Rats are the most harmful, the most destructive, the most menacing to human health, of all the animal pests.

Today with such an effective and efficient rat-killer available as ANTU—a tremendous opportunity for sales is open to you.

THE CHEMICAL—ANTU (alpha-naphthyl-thiourea), discovered by government-sponsored research during the war, is a highly specific poison for the brown (Norway) rat—*the rat most commonly found in cities, towns, and on farms in the U. S.* It is relatively non-poisonous to other rodents and animals. So far as is known, it is non-toxic to man except in large amounts.

ITS PROPERTIES—ANTU is a finely granulated gray powder. It is insoluble in water but soluble in some organic solvents including ethyl alcohol, acetic acid, dioxan and pyridoxine. It is chemically stable, non-volatile, and non-irritating to the human skin.

EASE OF MIXING—ANTU mixes evenly with all kinds of food (or ground grain) and adheres well to dry or wet foods when dusted on them. It sticks to the feet and hair of rats when they run through it. It dusts well from insect dust sprayers and pump guns.

HOW IT WORKS—ANTU kills through the stomach, not through contact with the skin. Rats die when they eat it in their food or lick it off their feet and hair—usually within 10 to 24 hours.

ITS APPLICATION—ANTU is a single-shot poison. Its success depends on the rat's getting a fatal dose at the first meal, since they quickly develop a tolerance which lasts about 30 days and an aversion which may last longer.

The J. T. Baker Chemical Co. is now ready to supply you ANTU for manufacturing purposes. Write today for prices.

Our descriptive bulletin gives latest information and recommendations on ANTU—how to use it—precautions to take. Send for it! Address *Agricultural Chemical Division*, J. T. Baker Chemical Co., 66 South Main Street, Phillipsburg, N. J.

THE COSTLY RAT!

RATS WASTE FEED

"About 50 pounds of grain or its equivalent are required to maintain one rat for 1 year, representing a minimum annual cost of 50 cents per rat for food actually consumed," says a Government Service. In addition, rats waste and contaminate about 100 pounds for every 50 pounds they eat.

RATS KILL CHICKS

Rats often kill apparently purely for the lust of killing. They have been known to kill several hundred baby chicks in a single night. Even full-grown hens and ducks, baby pigs, and lambs are killed. Large quantities of eggs are commonly destroyed.

RATS DAMAGE PROPERTY

Rat damage to property includes holes gnawed in many articles, including grain bags, leather, expensive upholstery, fabrics, furniture, doors, books, and even lead pipes—flooding, caused by burrowing in embankments—fires, caused by gnawing and short-circuiting electric wires—and undermining foundations of buildings.

RATS RUIN FOOD

To get at food rats usually gnaw through the container and ruin the whole package, although only a little is eaten. In warehouses, feed stores and mills, sacks of grain, stock feeds and flour are often spilled and fouled. In wholesale and retail grocery stores they gnaw into breakfast foods, crackers, bread, candies and almost all food products in cardboard, paper or wooden cartons.

RATS SPREAD DISEASE

Rats not only carry bacteria and other parasites on their feet and bodies, they transmit diseases of their own to man and domestic animals. Also, they acquire a number of human and livestock diseases, contributing to their spread. Diseases spread by rats include bubonic plague, typhus fever, spirochetal jaundice, rat-bite fever, food poisoning, tularemia, rabies, trichinosis.

HALF OF RATS ON FARMS

Government authorities estimate half of the rats in the United States are on farms . . . about 26 per cent are in non-farm country residences and in towns of less than ten thousand population . . . about 24 per cent are in cities of ten thousand or more. On the basis of observations by many people engaged in rat control, they roughly estimate there is one rat per person in the U. S.—about 137,000,000 rats.

LOSSES RUN INTO MILLIONS

A careful survey by one of the members of a Government Service last year resulted in the estimate of an annual loss of approximately $200,000,000 worth of cereals and cereal products as a result of foods eaten or damaged by rats. Total estimates of all damage range between $300,000,000 and $500,000,000 per year.

"If everyone understood the true status of the rat, how dangerous and how destructive a rodent it is, not a single rat would be allowed to exist in or near an abode or place of business."
—*U. S. A. Wildlife Circular 6.*

Baker

Baker's Chemicals

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FRIANITE

the Superior
Insecticide Diluent

Frianite M3x is the product which you read about when a dust carrier is chosen to make an insecticide better. Reference lists on request.

✓ *Check these features*

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2. pH range of 5.4 to 6.5.
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4. Bulk density about 47 lbs. per cubic foot.
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9. Dusts better in field or orchard.

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FRIANT, CALIFORNIA

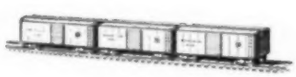
BASIC CHEMICALS

GENERAL CHEMICAL COMPANY

FOR AMERICAN AGRICULTURE

DDT

BHC



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Dichloro-diphenyl-trichloroethane

Technical—Ground or Flake
(89° Min. Setting Point)

50% DDT Wettable Powder, Micro-Fine
(Genitox* 550)

50% DDT Dust Base, Micro-Fine
(Genitox D50)

Emulsifiable Oil Concentrates
(Genitol† EM25 and EM30)

Solvent Concentrates
(Genitol SC30 and SC40)

■ BHC

Benzene Hexachloride

Technical Grade

Dust Base (Finely Milled)

Wettable Powder

Dust Mixtures

Oil Concentrates

†Trade Mark, General Chemical Company
*Reg. U. S. Pat. Off.

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Into their manufacture has gone extensive investigational work, and all the skill and experience gained by General Chemical in nearly 50 years as a leading producer of insecticides.

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AGRICULTURAL CHEMICALS

THIS MONTH'S COVER

A modern insecticide dust blending plant situated at edge of airport where planes may load right at the factory door. Complete story of new style custom dusting on page 18.

OCTOBER 1947
VOL. II No. 10

A Monthly Magazine For the Trade

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piperonyl cyclohexenone is rechristened as piperonyl cyclonene

When this insecticidal chemical was first introduced commercially several years ago, it was given the name Piperonyl Cyclohexenone, not as an exact chemical name but as one reasonably indicative of its chemical structure and at the same time reasonably simple to use. Extensive use has made it well-known.

• Recently, in connection with the re-examination of the whole problem of official nomenclature for complicated organic insecticide and fungicide materials, official objections have been raised to the continued use of the name Piperonyl Cyclohexenone on the logical but somewhat theoretical ground that a chemical for which this name would be correct chemically might exist, and that to that extent the name might become misleading. • To meet this objection and to cooperate in the attempted solution of the very difficult nomenclature problems, we have agreed to substitute the name PIPERONYL CYCLONENE. There is no change except in name. Piperonyl Cyclonene is the chemical formerly known as Piperonyl Cyclohexenone. • However necessary or advisable this change may be a certain amount of confusion is inevitiable, though we hope it can be minimized. Both names will be found in literature and other references for some time to come. • Piperonyl Cyclonene is now the correct and officially accepted name, but Piperonyl Cyclonene and Piperonyl Cyclohexenone are one and the same product. Labels, packages and sales literature should adopt the new name when present supplies are replaced.

D&O

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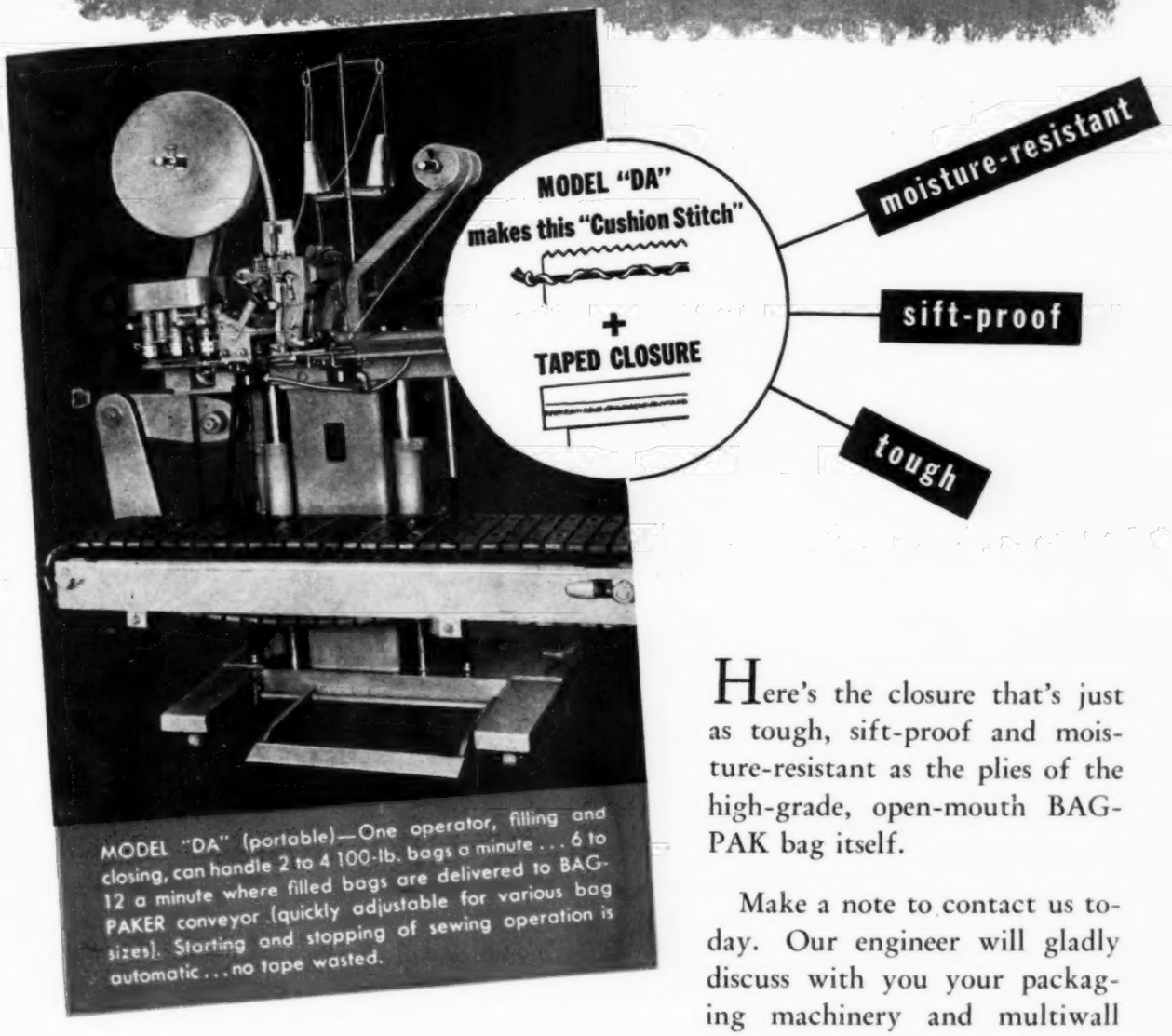

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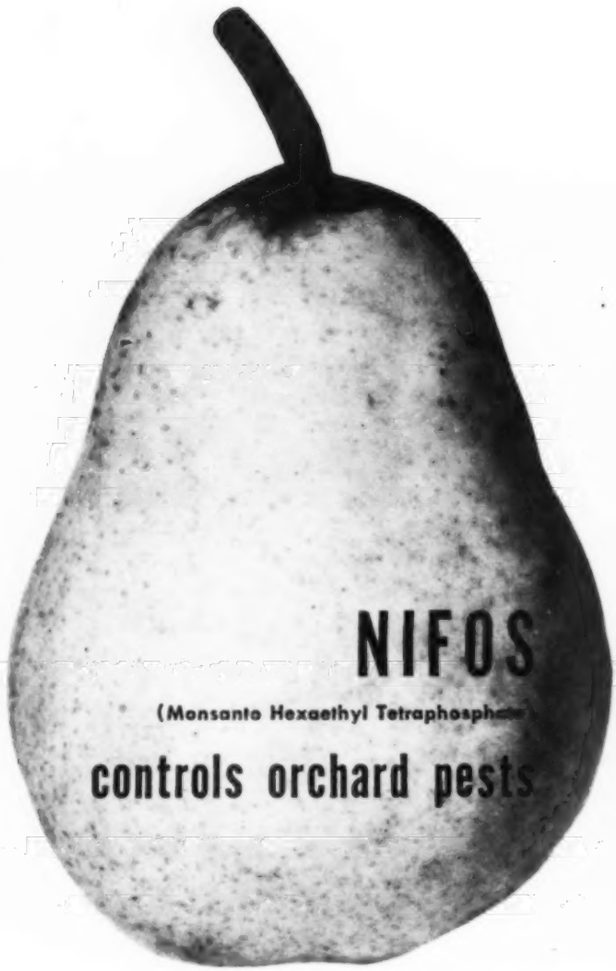

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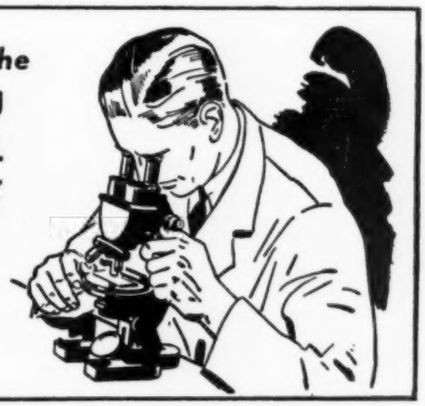
For official disinfection of cattle cars, trucks, boats or other premises harboring cattle or livestock.



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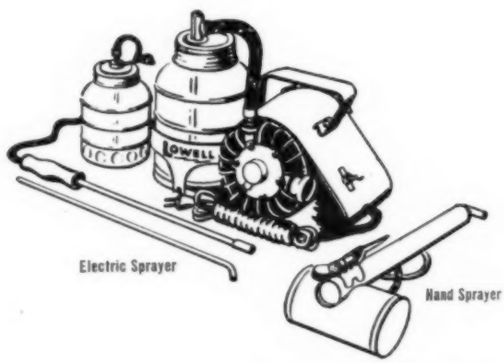

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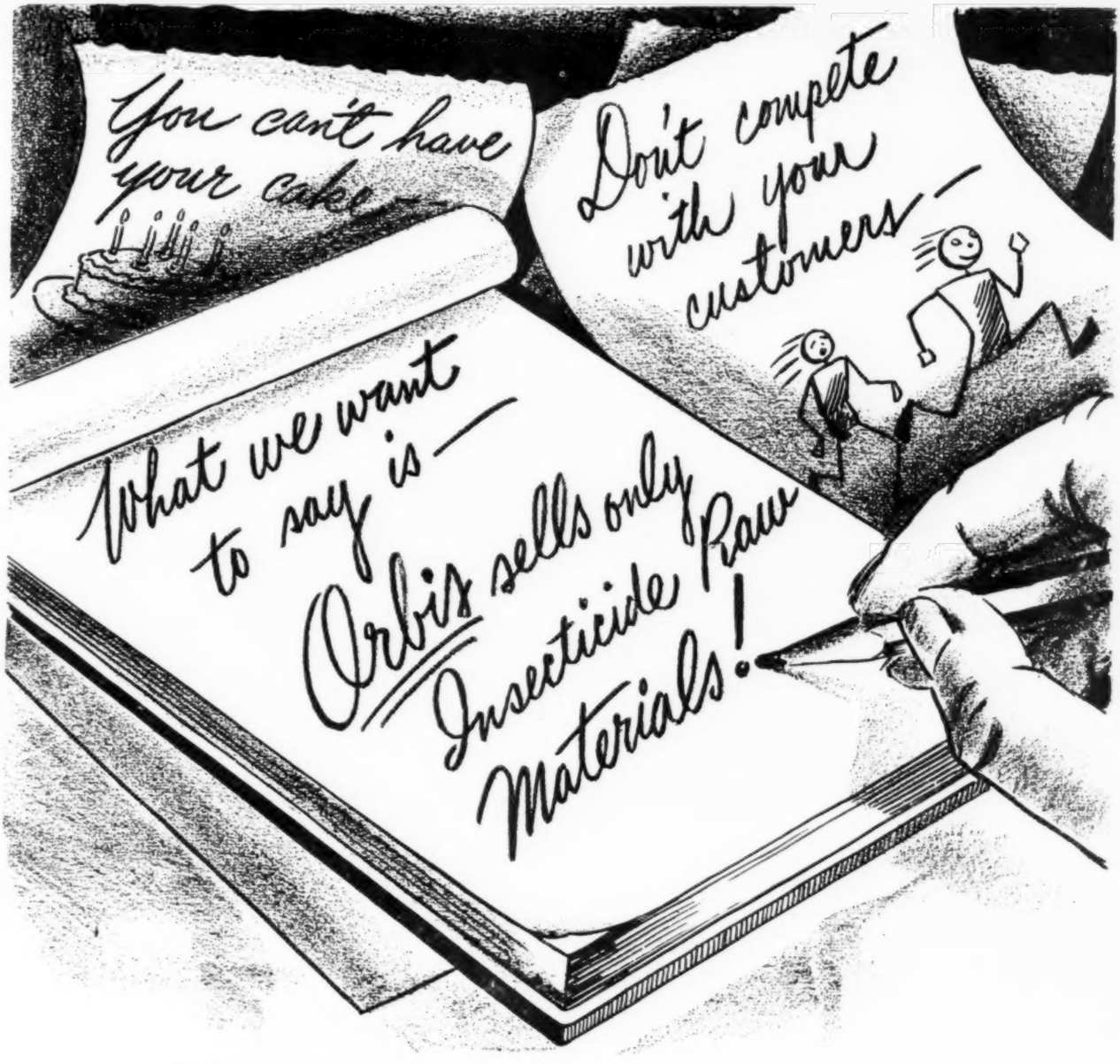
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Check your ANTU supplies now. The season for heaviest rat infestations is starting.

Write today for complete information and prices.

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BASIC MATERIALS FOR INSECTICIDE MANUFACTURERS

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THE EDITOR COMMENTS

WHEN highballing along a smooth level stretch of road at an accelerated clip, every driver is conscious that sooner or later he will come to a rough road with sharp turns where the pace must be slowed. The smooth road is never unending. But invariably, its end is marked by road signs. Today, a similar situation attends the fertilizer industry. Only, there are no signs.

Fertilizer production is running full speed ahead with sales mounting higher each year. Tag sales for 1946-47 amounted to 9,078,000 tons, an increase of eight percent over the average annual sales from 1935 to 1940. The prospects for next season are better yet.

How much higher production and sales will go, or *can* go, is anybody's guess. They cannot continue increasing indefinitely, although there is reason to believe that unsatisfied world needs and a steadily increasing domestic consumption will hold sales levels high for some years to come. But, eventually, a leveling off must come. What then?

With a proved ability for production planning, so amply demonstrated over the past five years, there is no doubt that leaders of the fertilizer industry are already peering ahead and considering plans when and if a saturation point is reached. They are looking for the answer to what will be the industry's most important post-war question. What happens then?

A NEW national policy of "sustained abundance" proposed by Secretary of Agriculture Clinton P. Anderson, will make necessary the continuance of high production in the agricultural chemical industry. It will mean, if adopted, a greater domestic market for fertilizers; the maintenance of chemical safeguards against insect infestations and plant disease, and should expand the weed killer market. In short, American Agriculture is going "all out" to produce . . . and the results will include a greatly increased use of chemicals.

In sharp contrast to former philosophies coming out of Washington, the Secretary states that this heavy schedule is to be "normal" . . . not entirely due to the Marshall Plan. With this in the offing, demand for all the chemicals of agriculture is likely to continue at a high level.

ON the principle that "if a little is good, a lot should be better," some users of insecticides and other toxic materials sometimes ignore state and federal recommendations, and douse their crops far beyond the specified amount of toxicant per acre. Such seems to be the case in New Jersey where some potato growers apparently used overdoses of benzene hexachloride for wireworm control, then later dusted or sprayed the material on the plants to control aphids. It did a fine job as far as the pests were concerned, but left the tubers with a rather unsavory taste which rendered many of them inedible in the opinion of some consumers.

Due to the care of most New Jersey potato growers, only a small portion of tainted tubers got into market channels, but these few have been enough to cause them great embarrassment. The insecticide itself was introduced to New Jersey growers purely as an experimental material which Dr. Bailey Pepper of the State Experiment Station emphasized was to be used only in a very limited way, and in quantities of not more than one pound of the gamma isomer per acre.

Careless application of a good product where all the answers are known can cause serious results. With the tremendous array of new toxicants coming on the scene, we cannot overemphasize the importance of heeding *all* the recommendations of experts who know the hazards involved. This New Jersey situation also illustrates the dangers inherent in putting any new material on the market before enough time has elapsed for study and appraisal,—and proves how right government officials have been in making haste slowly!

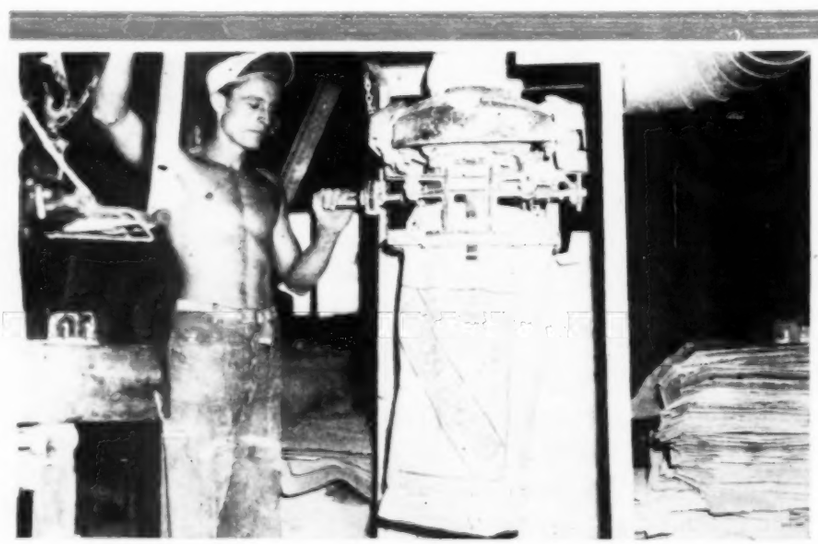
Something New in

CUSTOM DUSTING . . .

THE introduction over the past few years of scores of new insecticidal and fungicidal materials has made the problem of agricultural pest control so complex that the farmer cannot be expected to know all the answers. The complications arising from the use of new compounds, and the confusing array of names, numbers and other more or less complex nomenclature, bewilder even those in constant touch with the pesticide field. Accordingly, a definite trend is seen in the profession of custom spraying and dusting toward relieving the farmer of his pest control problems by assuming full-season responsibility for the application and results, and assuring adherence to good approved scientific methods and materials.

A good example of this trend is found in the operations of the new Vahlsing Insecticide and Chemical Corporation, Robbinsville, New Jersey, headed by Fred Vahlsing. The firm operates a modern blending plant at the edge of its own airport where planes may taxi up to the factory door, load up, and take off to dust fields of potatoes or other crops within the 200 square mile area served by the firm. Joseph P. McKenna, General Manager of the corporation says that the first year's operation has been completely successful, and that prospects for next year's business are extremely bright.

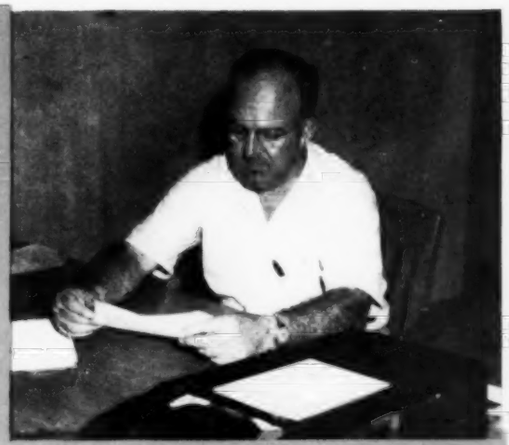
Mr. McKenna is a firm believer in following the recommendations of State and Federal pest control experts for control of various insect infestations and plant diseases. He has noticed, however, an inclination on the part of many farmers to have



Above: Lined up at Vahlsing's airport, these planes are being readied for service in the company's crop-dusting department. Some are already fitted with hopper and venturi, others await application devices.

Below: Insecticide dusts when completely blended by plant's new equipment, are put in bags for distribution. Efficiency is the keynote of this blending plant.

Contracting with the expert for full-season application of pest control chemicals is a growing trend today... how the large scale modern specialist operates is illustrated by activities of Vahlsing Corp. in New Jersey



fields dusted when it seems convenient, rather than when an optimum kill may be obtained. He also knows that the condition of the fields may not always permit the use of ground equipment, for instance following heavy rains, or on rugged terrain. So his dust insecticides are normally applied by plane.

Sales agents of the company, who in most cases are the plane owners who do the actual dusting, approach the farmers and contract with them to handle their insect and plant disease control problems on a full-seasonal basis. They point out that the farmer will not have to carry an inventory of materials, and that, should emergency conditions arise, the dust formulations can be altered quickly. (Such a condition occurred this year with a sudden infestation of red lice on tomatoes.) The agents also point out that by having his dusting done by airplane, the farmer's tractor and other equipment need never be diverted from normal farm operation purposes.

Greatest emphasis, however, is placed on the *program*. Regularity of application is stressed as being of utmost importance, and the Vahlsing Corporation guarantees to the farmer that the dusting will be done on schedule.

As a result of this missionary work in central New Jersey, the firm has dusted some 50,000 acres of crops in its first season. Contracts were signed during the recent growing season for a full control program on some 25,000 acres, for application of both insecticides and fungicides. The average farmer has a maximum of from 100 to 150 acres under cultivation in this section, Mr. McKenna reports, and this size operation hardly warrants an outlay by the individual farmer for complete equipment to control insects and plant disease on his own farm. It is not difficult, therefore, to sell a control program which makes it possible for a telephone call to bring quick action in controlling sudden infestations.

BACK of all external operations, of course, is the blending plant itself which appears to bear out Mr. McKenna's assertion that it is "one

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Above: Joseph P. McKenna, general manager of the Vahlsing insecticide and chemical plant at Robbinsville, N. J.

Below: View of new plant built at edge of airport where planes taxi to the door to be loaded. Plans for future include construction of platform and mechanical means for loading more efficiently.

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of the best in the country." He states that in securing control of plant disease and insects with airplane application, the control materials must be of superior quality. To prove his point, Mr. McKenna made spatula tests which showed the formulations from his plant to be completely homogeneous in composition as compared to competitive samples in which active material sometimes appeared as streaks or islands throughout the sample. "This is what we mean by superior quality," he says. It follows that if the dust has been thoroughly blended, uniform distribution of the active ingredient will be secured on the plants when application is made. One of the reasons for erratic control with dust as compared with spray materials, is this factor, he declares.

Mechanically, the Vahlsing plant is equipped to do a thoroughly efficient job of blending. A new Sprout, Waldron unit, installed when the plant was built this spring, does a very commendable job of blending, according to Mr. McKenna who points with pride to the general freedom from dust in the plant. Aside from a small amount of spillage when the bags are filled, the remainder of the room is practically dust-free. The plant, incidentally, was designed by Edward Michel who acts as chief engineer. Visitors from many parts of the U. S. and from points as far away as Canada and Cuba have come to see the plant in operation. Plans are underway for a major expansion program in the spring to take care of storage and increased production scheduled for next season. In this connection, the corporation expects to add to its customer service a new and completely modern laboratory to aid farmers of the vicinity in solving problems of plant nutrition and plant disease.

THE type of diluent used in insecticidal dust blending for airplane application is considered to be of particular importance by the Vahlsing Corporation. Mr. McKenna explains that dusts blended entirely from the heavier type diluent are apt to "bridge" in the hopper and cause missed areas in the field. When the pilot causes the plane to fly in an erratic manner to jar loose the "bridge," the dust emerges from the hopper in a sudden heavy stream, causing excessive application to that portion of the field, at the expense of other parts untouched.

On the other hand, dusts blended entirely from lighter diluents will tend to float when released from the plane, and drift up and away from the field . . . a condition which has brought some criticism of the use of airplanes in dusting and spraying. In addition to the possible drift hazard to neighboring crops, the field being treated receives only partial and inefficient coverage. There will also be an undue separation of active and inert ingredients in such a dust as it settles, causing unequal distribution of the active material.

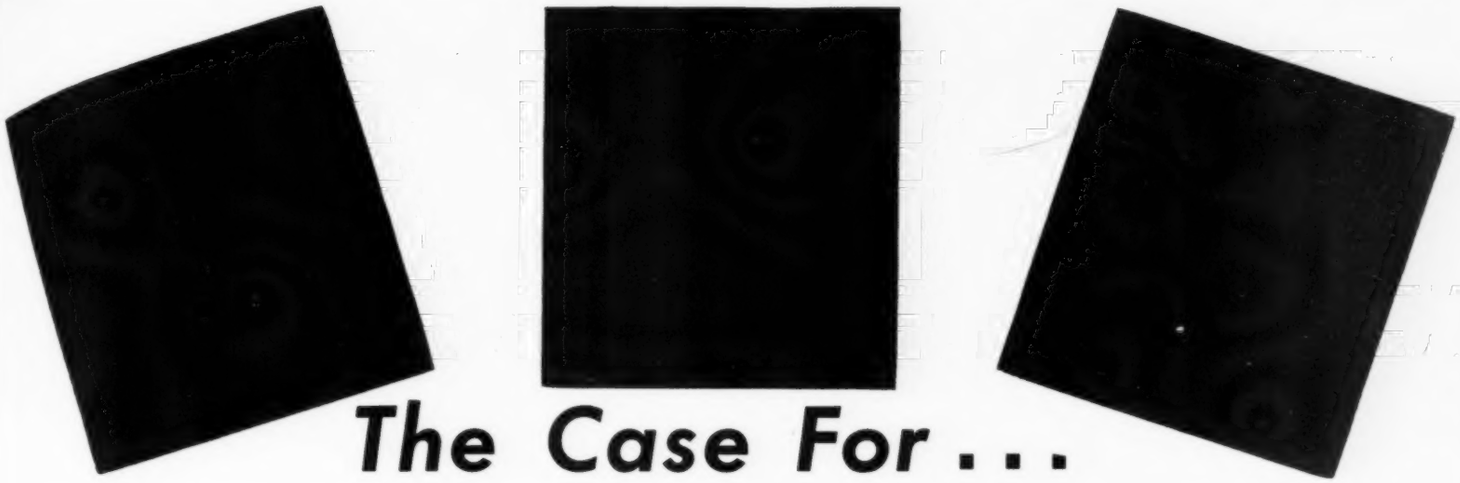
The Vahlsing Corporation emphasizes that a dusting pilot must have qualifications far beyond the mere ability to keep a plane in the air. Selection of pilots is based on their previous crop dusting experience. Those now in the Vahlsing service have had from 10 to 15 years of crop dusting experience under varied climatic and atmospheric conditions in Florida and in the southwest. They thus have a close working knowledge of the control to be expected with various insecticides and fungicides, and the manner in which the particular material should be applied.

Serving from the Robbinsville plant is Curtis Cherry and his brother, Dick, proprietors of the Cherry Flying Service, with two fields in N. J. They have been doing similar work for the past 16 years, and recently purchased additional planes soon to be fitted for dusting service. John Van Sant, owner of Old Star airport and crop dusting service, operates out of Langhorne, Pa., serving the counties of Bucks, Montgomery, and Philadelphia in Pennsylvania, and part of Mercer County, N. J. Chris Stoltzfus of Coatesville, Pa., services the eastern shore of Virginia and Maryland, and the counties of Lebanon, Lancaster, York, Adams and Chester in Pennsylvania. Lewis K. Barton is agent at Haddonfield, N. J., and hires Graham Denham to operate a similar service out of Bellemawr, N. J., contracting with farmers for a season's dusting service in the South Jersey area. About 90 percent of the output of the Robbinsville plant is used in the air dusting service, the general manager stated. Production during the first season was more than 50 percent above what was thought to be the plant's capacity.

Less than a year ago, much of the land now comprising the airport, plant site, and various potato and vegetable fields, was a huge weedy swamp which had been long since abandoned as useless. Mr. Vahlsing laid pipes, drained off the water and built his dust plant and airport on the site. His land in the area totals some 5,000 acres. His original dusting activity there was in connection with an infestation of Colorado beetles on his potato crop. Airplanes were used for dusting, and the results were so outstanding that neighboring farmers requested similar service for their crops. This furnished the spark which started the custom dusting business which in turn developed into the need for an insecticide and fungicide blending plant with numerous planes employing its output.

The Robbinsville operation is but one of many large scale agricultural projects developed by Mr. Vahlsing. His largest enterprise is in the vegetable-growing field in which he has thousands of acres under cultivation. One farm in Texas comprises 25,000 acres, including 3,000 acres of carrots, 1,500 of broccoli and 500 of parsley. He uses airplane dusting almost exclusively for control of insects and plant disease.★★

Intimate blending of dust materials has helped to solve airplane application problems, and aids control of dust drift...good equipment is answer



The Case For . . .

FERTILIZER SOLUTIONS

by
V. A. Tiedjens
Director,
Virginia Truck Experiment Station

APPLICATION to growing crops of water solutions of fertilizer is not a new practice, although use of liquid fertilizer in the commercial field is a comparatively recent innovation. In some areas liquid fertilizer is widely used, and many diverse opinions are encountered regarding it, as would be true with any such innovation. A new practice seems always to meet with resistance, but when certain obstacles are overcome, the former difficulties are soon forgotten and one wonders why there should have been any question about it at all.

Application of fertilizer in solution has many advantages and of course some disadvantages. From the standpoint of uniformity of distribution on the soil, and subsequent diffusion in the soil, use of fertilizer solutions is far superior to the application of dry fertilizer. As a matter of fact it is the only means of establishing equilibrium of the nutrient ions quickly. When applied in solution form they are quickly available to the plant and an immediate response in the plant's growth can be anticipated. This has been demonstrated time and again. Historically, fertilizer solutions were used long before dry chemical salts were considered for use as soil amendments to increase plant growth. The practice of early American Indians in burying fish in corn rows, more closely approximated the use of fertilizer solutions than it did dry fertilizer.

The use of weak nutrient solutions to grow plants was started a number of years ago by laboratory workers who were looking for information on the effect of nutrients on plant growth. These were called water cultures, sand cultures and more recently gravel and cinder cultures. Exacting methods were necessary to grow plants to maturity in these cultures because it was necessary to provide exact amounts of all needed plant nutrients. Since we know that very minute amounts of such elements as boron, manganese and iron are necessary, and that the limits of safety are so very narrow, it is remarkable that the early workers were even remotely successful in growing plants to maturity in such cultures. Also these nutrient solutions were found to be very efficient in promoting plant growth. The application to soils of fertilizer in solution is therefore a natural development in the use of chemicals for growing plants.

The ever increasing cost of growing crops, the need for higher yields and the apparent low recovery from applied phosphates in the soil prompted the initiation of research projects to study the possibility of giving crop plants a liquid diet. This too seems like a natural development in the sequence of events leading to a better understanding of how soils take up nutrients, distribute and supply them to the growing plant and how the plant in turn uses them to produce food for animals.

Plants in the wild or natural state make a far larger volume of growth per unit of available nutrient than do our cultivated plants. These plants have been tamed to serve the needs of man better and several things have happened as a result. Either plants have been developed which have a much higher nutrient requirement, or the natural chemical changes in the soil have been interrupted so that the soil supplies less and less of the needed nutrients for crop production. Perhaps both possibilities are involved. However, it must be admitted that an acre of cultivated field corn far outyields an acre of corn in the wild state. Experiment stations have wrestled with the problem of gaining more efficient production for some fifty or more years and it is interesting to note how the fertilizer solution idea has kept pace with fertilizer studies.

THE application to the soil of the liquid extract of manure for crop production is an old European practice. The use of the liquid "night soil" to grow crops in China dates back many centuries and even today it is the backbone of the crop fertilization practice in China. Such methods have never found extensive

Liquid fertilizer results have encouraged further study. A number of applications are already accepted . . . particularly in Europe

use in the United States, however, in part because the practice was considered too expensive. It meant building cisterns and providing means of distribution to the fields. In the early days of our development it was easier to move to new land than to conserve our fertility. Later it was cheaper to buy a 100 pound bag of fertilizer than to handle 2000 pounds of liquid. Now that we have no new fertile land to which to turn, however, we are going back and re-evaluating some of our old practices and rejuvenating our depleted soils. The use of liquid animal manure produces excellent results and if a grower applies enough to a given area he can produce far better crops than he has ever been able to do with commercial fertilizer. George Barber, the Diamond match king, probably had the best example in this country of getting results from animal manure. He did it as a hobby at tremendous cost. But it could have been done very economically.

He built a 4-story cow barn on a hill and covered 10 acres of land with glass in a lower elevation some ¾ mile distant. The manure from his animals was dropped into pits below the floor and covered with water. The water with the soluble nutrients from the manure drained into cisterns below the manure pits. From these cisterns the liquid was conducted in an underground pipe to the greenhouses where it entered the irrigation system and was sprinkled on the soil around the growing crops. People who worked in these greenhouses say that never have such luxuriant crops been grown in those greenhouses with commercial fertilizer, as Mr. Barber succeeded in growing with his liquid solution. Why?

Experiment Station workers are still trying to find the answer. They are making progress but the evidence is still in favor of animal manures. Animal manures are available only in limited quantity, however, and were it not for the use of commercial fertilizezrs our food production would be far below meeting the needs of our rapidly increasing population. Incidentally, we have yet to learn how to use commercial fertilizer most efficiently. Thus it is only natural that much of the research in Agricultural Experiment Stations centers around the fertilizer problem —particularly, how to get the results that our forefathers got with animal manure.

There are a number of applications of liquid fertilizer which are already quite commonly accepted. The use of nitrogenous fertilizers in irrigation water in the field and in the greenhouse is being practiced in many areas with excellent results. In some European countries the application of anhydrous ammonia to the soil is an accepted practice. In most cases these treatments have been considered as supplementary to applications of dry fertilizers. In few cases have the total fertilizer ingredients needed by the crop been applied in solution form.

The use of dilute solutions of phosphoric acid in transplanting water for tomatoes was developed by a county agricultural agent in the middle west. The corrosive action of the acid deterred commercial use in spite of the fact that it produced worth while crop responses. This was developed further by Dr. Jackson B. Hester of the Campbell Soup Co. to the extent that a large part of the tomato plants grown in New Jersey are now set out with a transplanting solution.

There are several reasons why there has not been wider acceptance of the practice of applying fertilizer in solution. In the first place, the unavailability of water has made it difficult for many to adopt the practice. Use of liquid fertilizer calls for hauling water, and in many cases pumping by hand. Most growers prefer to apply insecticide dust rather than sprays, even if less effective, because it requires less work. It is likewise easier to carry fertilizer to the field in bags than to haul water in barrels. With the proper equipment such as cisterns, pumps and pipe lines, however, a farmer can apply fertilizer solution with far less work than is required for application in the dry form.

Secondly—there has been difficulty in buying a form of phosphate that would dissolve readily in water. Prior to the last war we had available several commercial forms of phosphates which could be used for solution purposes. The mono-and di-ammonium phosphates were particularly suited for this purpose. During the war years it was necessary to dissolve as much as possible of the calcium phosphate of superphosphate. This would discourage many from using fertilizer solutions, although it has not discouraged gardeners who could throw a handful of fertilizer in a pail of water and pour it around their plants. So far but little satisfactory equipment is available to apply fertilizer solutions efficiently.

Third—information on how to use fertilizer solutions has not been available. Few publications are available because few Experiment Station workers have studied how to use fertilizer solutions.

Fourth—there is the human element which carries much weight for those who have not considered all aspects of the problem. The commercial fertilizer industry has done much to encourage research workers to find facts on the best use of its products. Early experiments on the use of fertilizer solutions however, showed some rather outstanding results which indicated that fertilizer in solution may be more efficient than when applied in dry form. The use of fertilizer solutions has been branded as a "fad" by some, and there is evidence that in some quarters little effort has been put forth to promote their acceptance. The extent to which liquid fertilizers may be used in the future can only be estimated now . . . but the writer

predicts that larger amounts of fertilizer will be used if the country starts the use of solutions. A greater volume of produce will be grown with a given amount of fertilizer in solution, if results from experiments are any criterion.

Any water-soluble fertilizer ingredients may be used for solution. Practice is not standardized . . . future tank service possible

FERTILIZER solutions may be divided into three major groups:

Transplanting solutions are very weak mixtures. On a concentration basis they might be formulated as a .09-.18-.09 on a 1-2-1 ratio basis, or .9-.9-.9 on a 1-1-1 ratio basis in contrast to a 5-10-5 or 5-5-5 on a dry basis. In other words, it would mean 7.2# of 5-10-5 fertilizer dissolved in 50 gallons or 400 lbs. of water. This solution is poured directly on the roots of the plants when they are set in the field and before they are covered with soil.

A starter solution (.125-.25-.125 or a .125-.125-.125) (10# 5-10-5 or 5-5-5 in 50 gallons of water) is slightly stronger and is applied to seed as it is sown. The solution is applied directly to the seed before it is covered with soil.

A booster solution is used for side dressing after the plants are well established. It would have a formula of at least .3125-.625-.3125 (25# of 5-10-5 in 50 gallons of water) or as high as .6-1.2-.6 depending on the solubility of the ingredients. (9.6# of 13-26-13 in 50 gallons of water would be equivalent to 25# of 5-10-5).

Up to the present time there has been no attempt made to standardize fertilizer solutions since the practice has consisted of simply taking dry fertilizer mixtures and dissolving them in water at concentrations which through trial and error have been found to be safe for use. The widespread use of fertilizer solutions would require many changes in the industry. Instead of making up dry mixtures the retailer would install a tank truck service to the grower, and instead of storage space the grower would provide himself with tanks much the same as oil companies now handle oil and gasoline products.

When such equipment is available, there will be no limitations on what ingredients may or may not be used for mixing. A dealer would buy his nitrogen solutions, his phosphoric acid and potash salts which would have to be dissolved. These would be run into mixing vats where pH and concentrations would be controlled. Then, instead of making a 5-10-5 or a 7-7-7 the solution would be a .1-.2-.1 or a .1-.1-.1, or whatever concentration might be desirable to serve as a stock solution. All minor elements could be added and the grower would be assured of a complete nutrient solution. To obtain the maximum concentration of nutrients, calcium and magnesium salts would have to be kept at a minimum. These would be supplied to the soil in the form of magnesium limestones, which would be much less expensive than suppyling them as soluble salts. By this method it is possible to make a solution having a concentration of 1.625-3.25-1.625 or some equivalent concentration.

Any fertilizer mixture can be used for making a fertilizer solution providing the ingredients are soluble in water. Organic materials are not satisfactory because they do not dissolve in water. An ordinary 5-10-5 dry, acid fertilizer made up of inorganic chemical salts when dissolved in water makes a mixture having a 5-7-5 soluble nutrient ratio. If it is a neutral 5-10-5 the soluble nutrient ratio will be 5-5-5 due to the fact that calcium phosphate does not dissolve readily in a usable fertilizer solution. There are higher analysis fertilizers on the market, such as 12-24-12 or 13-26-12, which are almost completely soluble if not used in too high concentrations. One half pound of 5-10-5 fertilizer in one gallon or 8 pounds of water is as concentrated as one should try to make them. On the other hand one pound of 13-26-13 in one gallon of water will dissolve due to more highly soluble ingredients. The former mixture would be .3125-.625-.3125 while the latter would have a formula of 1.625-.25-1.625.

The application of a fertilizer solution, per given area, is measured in volume instead of weight as in dry fertilizer.

A transplanting solution is applied at the ratio of half pint to a large plant or one fourth pint to a small plant. The amount needed per acre then depends on the number of plants. Tomato plants set 4 x 4 feet (2723 plants per acre) would require 85 gallons or 680 pounds of solution. This would require 12.3 pounds of 5-10-5 fertilizer. Experimental results show that plants on the average soil will produce 2 to 3 tons of tomatoes as a result of the application of this fertilizer; in other words, approximately $75.00 return for an expenditure of less than $1.00 for fertilizer.

In the case of sweet potatoes where plants are set 3′ x 15″, 11,700 plants would be needed. This would require 365 gallons or 292 pounds of water or 52.6 pounds of 5-10-5 fertilizer. The writer has harvested 154 more bushels of sweet potatoes as a result of this treatment. Here again we have a gain of $154.00 (at $1.00 per bushel) from an expenditure of $2.00 for fertilizer. It is figures such as these which prompt one to investigate further the possibilities of fertilizer solutions since dry fertilizer applications do not begin to return such amounts for $1.00 invested in fertilizer.

The use of starter solutions on seeds has not given such good returns. Neither have booster solutions or sidedressings given such large returns. One commercial grower reports that by putting a fertilizer solution 12 inches below his tomato plants he took in $4.00 for every $1.00 he received on his tomatoes fertilized in the usual method (side dressings) from equal acreages.

Another grower, whose 50

(*Turn to Page* 68)

AIFA

FOUR new directors were named, other officers were re-elected, and many problems facing the industry were discussed at the 14th annual convention of the Agricultural Insecticide and Fungicide Association at Spring Lake, N. J., September 2, 3 and 4. An industry forum presenting viewpoints of future business as seen by basic producers, national distributors, and direct-to-consumer sellers, was an outstanding feature of the meeting. Other features included papers by representatives of government, industry and allied fields, covering the new Federal Insecticide, Fungicide and Rodenticide Act, new materials appearing on the market, and problems concerning labeling, markets and legislation.

Although the meeting opened officially on Tuesday, that day's activity consisted of committee meetings. The first open sessions were held on Wednesday morning. AIF president George F. Leonard, Tobacco By-Products Chemical Corporation, Louisville, Ky., welcomed the group, terming the occasion "auspicious," since it marked the completion of 14 years of successful Association activity. Lea S. Hitchner, executive secretary, presented a summary of his annual report, pointing out how the Association endeavors to gear its projects to the interests of American agriculture by helping the insecticide, fungicide and other pest control manufacturers to hold down excessive costs in doing business. He mentioned the Association's interest in the enactment of simplified State laws in order to avoid the complication and extra expense involved in conflecting regulations in the several States. He also pointed out the cost to the farmer of several millions of dollars which would have been involved if every economic poison product were to be registered at a high annual fee in all the States.

Dr. P. N. Annand, Chief of the Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture, presented a paper discussing problems related to the general use of new insecticides. Full text of his paper appears elsewhere in this issue.

Following Dr. Annand, Dr. George C. Decker, entomologist of the Illinois Natural History Survey, Champaign, Ill., told of recent developments in European corn borer control throughout the corn belt, describing some of the problems in this connection. Corn borer control is not a single over-all problem, he said, because corn crops vary widely in value, depending upon the use to which they are to be put. For instance, where the ears are to be sold on the market, consumers demand worm-free corn and will pay a premium price to get it. This makes feasible frequent

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MAURICE H. Lockwood, president of American Fertilizer Association, speaker at the A. I. F. meeting, thought he saw a familiar face at another table at dinner one evening. Looking closer he recognized Dr. C. C. Compton of Julius Hyman & Co., Denver, a former schoolmate at Connecticut Ag. College, whom he had not seen for 26 years. They spent quite a time in antimated reminiscing. . . . Dr. Al Weed, John Powell & Co., Inc., says he will have New York acto license No. 2,4-D next year. Being a "narrow-leaf" type Doc isn't frightened.

Swimming and surf bathing in the Atlantic attracted many of the men as usual, although the waves were high and the surf usually too strong for comfort . . . The beach was populated almost immediately following each day's business session. . . .Strong swimmers and sun bathers included Harold Feuchter, J. T. Baker Chemical Co.,; R.F. Byrnes, Rohm & Haas Co.,; Joe Cary, Ex-pres. of AIFA, of Food Machinery Corp., now of San Jose, Calif.; Wallie Moreland, Rutgers University; "Grub" Leonard, Association President; C. Y. Haas, Attapulgus Clay Co.; Bill Feustel of R. T. Vanderbilt Co.; Henry Wood, (Henry"doubled in brass" as golf chairman) Tobacco By-Products & Chemical Corp.; and Dr. S. E. A. McCallan of Boyce-Thompson Institute . . .Incidentally, where did Dr. McCallan learn to ride the waves so well . . .certainly not in his native Bermuda!

A couple of the boys, Ed Camson and George Hartz of Orbis Products neglected to bring swimming trunks, so they borrowed some from the hotel's assistant manager, Jack Crandall . . .A few Mr. and Mrs. groups were beach addicts including the Douglas Malcolms, R. T. Vanderbilt Co.; the Harold Nobles, S. B. Penick & Co.; the N. C. Thorntons, and Carl A. Setterstroms of Carbide & Carbon Chemicals Corp.; and the Friar Thompsons of Prentiss . . . Mary McCormick and Mrs. Lee Manzie were among the ocean bathers too, when they could get away from the registration desk for awhile.These girls not only added to the over all beauty of the place, but did good jobs answering questions regarding the meeting and people in attendance . . . Speaking of the ladies, quite a number were present at the annual banquet Wednesday evening, a definite innovation. Door prizes were awarded to four ladies following dinner. . . Winners were Mrs. Wallace Moreland, Mrs. Carl Setterstrom, Mrs. Harold Noble, and Mrs. Friar Thompson.

During the banquet awards were presented to winners in the golf tourament held that afternoon. Presentation was made by the indefatigible Henry Wood, chairman of the golf committee, to the following : R. F. Allen, American Cyanamid Co., low gross, 82; J. I. Shafer, B. G. Pratt Co., low net, 70; Russell B. Stoddard, Dodge & Olcott, Inc., lowest number of putts; Fred R.George, American Agricultural Chemical Co., most birdies; A. G. Aitchison, Westvaco Chlorine Products Corp., kicker's handicap; John Nicholson, *Agricultural Chemicals*, best par 3 holes; Jack Vernon, Niagara Sprayer & Chemical Division, best selected 6 holes; M. K. Perinchief, Virginia Smelting Co., best poker hand; W. J. Haude, John Powell & Co., Inc., most putts; R. T. Yates, Hercules Powder Co., high score on hole 3; and Melvin Goldberg, Geigy Co., Inc., high score . . . The last three new AIFA records.

Our admiration goes to "Grub" Leonard, A. I. F. president in his heroic struggle to make his voice heard over the hotel's alleged microphone, which he described as "the most perverse of all inaminate objects" . . . . wonder why the hotel doesn't junk that P. A. system for one which works at least part of the time?

The "hot nite spots" along the Jersey Shore received some patronage from AIFA conventioneers . . . . The Homestead, Beau Rivage and Avon Inn were among the more popular spots, while the Essex and Sussex tap room was a busy place at cocktail time . . . . also after and before cocktail time . . . and other times too . . .

The golf course at the Spring Lake Country Club was littered with divots . . . watching Ted Reideberg of Westvaco and Doc Skaptason of Powell beat each others'

In 14th Annual Convention

applications of insecticide to assure sound produce. As many as six insecticide applications are made in one season for high grade corn, Dr. Decker said. For other uses, such as for seed crops and for canneries, the necessary percentage of worm-free corn is a little lower, which brings down the necessity for as many applications. Some growers use as little as one application in a single season, he said.

The most successful insecticides used in borer control are Ryania and DDT, with the former having a slight advantage because of its lack of toxic residues. The residual properties of DDT are against its use in some cases, he said. As to application methods, Dr. Decker stated that for the most part ground application has proved to be more effective than application from airplanes. Spraying has shown superiority to dusting, both from the standpoint of cost and effectiveness. Oil concentrate sprays are showing promise, and may prove superior to all other types eventually.

New Law Discussed

ALTHOUGH unable to give a full report on the regulations for enforcement of the new Federal Insecticide, Fungicide and Rodenticide Act, S. R. Newell, Acting Assistant Administrator for Marketing, Production and Marketing Administration, U.S.D.A. reviewed the history of the Act, told of its development over the past several years, and explained its numerous points of superiority over the Insecticide Act of 1910. He reminded that the bill was not entirely the product of the Department of Agriculture, but that industry played an important part in its development. In administering the Act, he indicated that the policy of the U.S.D.A. will be one of trying to prevent violations rather than sitting by to punish those who deviate from the provisions of the law. This requires the complete cooperation of the industry as a whole. "We need a healthy, strong industry to protect the agricultural crops of the country," he said. The principle behind the law is to protect the legitimate manufacturer as well as the public. The economic poison industry is entering a new phase under the Act of 1947, he declared, and it will take time to work out every problem and question arising from it. Every effort will be made to find the best possible solution to each problem.

Dr. W. G. Reed, Chief of the Insecticide Division, Livestock Branch, Production and Marketing Administration, followed to present specific information regarding the new law, giving examples of what materials are included under the term "economic poisons," and at what stage in their manufacture they come under the new controls. Materials such as

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brains out for nine holes was a revelation . . . Skap quit on the tenth tee to act as money changer for Jack Miller of Atlas who made book on the tricky water hole and Ted struggled on alone. . . Ed Phillips of GLF hit each drive about one full mile, but "where it stops nobody knows" . . . Jack Vernon of Niagara Sprayer also slugs 'em a mile, and a neat golfer, but that lousy 13th hole where he took a juicy eight . . . Ed Camson of Orbis "snuck" home early to await the expected arrival of one more addition to the Camson tribe. Jack Thom of Westvaco stepped out in the golf tournament with some pretty fast company, one man with a 77 . . . said Jack: "I went along chiefly for the ride."

Paul Torpin of McLaughlin-Gormley-King was a good pinch hitter for George McLaughlin and Clay Schroeder who were scheduled to appear, but didn't . . . Merrill Crouch of United Co-ops is a singer of parts . . . from his choice of songs, we judge he was exposed to education at Illinois . . . ever see a one-armed paper hanger with hives? . . . that was Lea Hitchner during the three days of the meeting. and what were you doing in Asbury Park, we heard a pal ask one Mercer Rowe, the new V. P. of Flag Sulphur . . . and you too, Bill Merrill?

The belle of the ball at the dance following the dinner party was Bill Andrews' young daughter who danced all of 'em dizzy . . . seen riding to N. Y. after the meeting, buried in luggage, were Messrs. Taylor and Farrell of Taylor Chemical, and Old Man Cavanaugh of the Dow Clan. . . reports have it that Scott James of Micronizer can also sing as well as dance . . . The Merrilll referred to above is Ashcraft-Wilkinson's pride and joy . . . . overheard discussing the nation's financial future in hushed whispers in the bar, one Bill (actually George Raymond) Rinke of Powell, new AIFA director and Bob Wilson of Michigan Chemical. . .

Censored due to the presence of ladies at the dinner this year was the usual rendition of that epic song "Don't Give Me No Goose for Christmas, Grandma," by Paul Mayfield, Hercules Powder's crooner and student of the horse; and Friar Thompson, of R. J. Prentiss Co., the "rebel" whose sonorous voice always lends quaintness to the song.

. . . "Right down the middle Heller," — that was dead-eye George Heller of Du Pont in the golf battle . . . a little luck and he would have been in there with the boys up top . . . belting Frank Rapp, Hercules slugger, had trouble locating both fairways and greens for the first nine . . . the second nine was different . . . he collected . . . for droll stories, Wotherspoon of Orbis, Gibbs of Merck, and Stoneleigh of U. S. Rubber are each awarded one gold-plated tomato . . . Doc Brasfield headed the U. S. Rubber contingent . . .Frank Maughan and Ray Byrnes carried the flag for Rohm & Haas . . .

Gopp of Michigan Chemical was sad indeed . . . he missed the poker game . . . VanWinkle of Julius Hyman Co., who slept while the poker players sat on his bed was fortitude personified . . .the Du Pont delegation was the largest . . . headed by T. H. McCormack, it included also Gus Oehm, F. D. Sparre, S. J. Hill, J. H. Jordan, H. P. Mansfield, and George Heller . . . Stauffer was next with R. K. Goodhue leading a parade of Dan Keating, the Portland, Ore., Division, R. R. Walcott, and John Paul Jones of New York. Mike Somerville and Tom Smith batted for S-W which translated means Sherwin-Williams . . .

The only unfortunate happening of the whole meeting occurred Tuesday night when Jack Brunton, eastern sales manager of the agricultural chemicals division of Pennsylvania Salt Mfg. Co., fell from a balcony when a railing against which he was leaning while talking to Bob Zipse of Geigy Co., gave way. The two men fell to the roof of a porch one story below, Jack receiving a serious spinal injury and Bob a severe shaking up. Jack was rushed to the Fitkin Memorial Hospital in near-by Asbury Park where he was placed in a spinal cast which was later replaced by a more comfortable brace which permits more movement. Latest reports indicate he is at his desk part of the time, but will be wearing that brace for awhile yet.

A representative audience at one of the business sessions at the Spring Lake Meeting in Sept.

sulfur and caustic soda when sold through regular trade channels do not come under the terms of the law until they are processed for use in toxic materials. The distinction between the words "label" and "labeling" was made, the former being the printed matter attached to the package itself, and the latter including all matter accompanying the article, and booklets and circulars referred to on the labels.

GEORGE F. LEONARD

Forum Discusses Future

AN industry forum was held at the Wednesday morning session in which the outlook for 1948 and future years was considered. Moderator of the session was Wallace S. Moreland, assistant to the president of Rutgers University, New Brunswick, N. J., who introduced the other three participants. First speaker was Russell Stoddard of Dodge & Olcott, Inc., New York, representing the basic producer's viewpoint. He said that a continually rising demand for the industry's products is ahead, its extent depending of course upon weather conditions and economic factors. But with the increased demand will come additional problems because of the introduction of new materials and the questions arising from their effect upon the market. Where in the past a producer could estimate fairly accurately the potential market and prepare for it, the picture is now much more complex because of new materials. "No one can tell how business will be divided up with regard to these new materials," he said. Over-confidence and over-production of any one product will be unwise, he warned, and summed up his forecast by remarking that business will be good, but there will be more problems than ever before.

Ernest Hart of Niagara Sprayer & Chemical Division, Food Machinery Corp., Middleport, N. Y., discussed the situation from the standpoint of a national distributor, urging an expansion of its base of service through increased promotion of weed killers, seed treatments, hormones, defoliants and other related materials, and to find greater uses for present materials.

E. H. Phillips of GLF, spoke from the viewpoint of the direct-to-consumer seller. He said that growers are impatient with excuses, and that they demand service on a pre-war basis.

They also expect insecticidal and fungicidal materials to be fully

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Re-Elected A. I. F. A. Officers

George F. Leonard, vice-president of Tobacco By-Products & Chemical Corp., who has been A.I.F.A. president since 1946, succeeding Joseph H. Cary.

Mr. Hitchner, continuing as executive secretary and treasurer of the association, has served the group for some 14 years. He was president for a term of two years, following which he assumed his present position.

LEA S. HITCHNER

Tetraethyl Pyrophosphate

By

John S. Harris

Monsanto Chemical Company

Progress report shows effective use in controlling various insects .... physical properties generally similar to H.E.T.P.

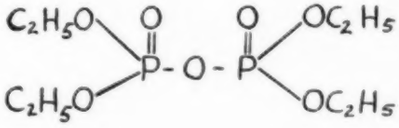
AN old compound in the chemical literature, but new to the agricultural field, tetraethyl pyrophosphate is being applied widely this year to a number of crops and against a variety of insects. The results of these tests conducted by Government, State and University experiment stations and insecticide formulators will provide the basis for their recommendations on the use of this material as an agricultural insecticide. In order to assist in this evaluaton and to make generally available the information on hand, the following "progress report" is presented:

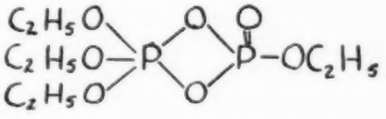
As early as 1854, Clermont (5) reported the preparation of tetraethyl pyrophosphate by the reaction of ethyl iodide and silver pyrophosphate. The compound was described and its hydrolysis in water was noted. Later work with the chemical was chiefly in an effort to determine the structure of pyrophosphoric acid. Thus far the only known publication on the insecticidal activity was made in the recent paper of Ludvik and Decker (6) in which was reported the evaluation of a number of phosphorus compounds. This work indicated that tetraethyl pyrophosphate possessed a very high order of insecticidal activity.

Physics and Chemistry

AS with many phosphoric compounds, the determination of the structure of pyrophosphoric acid (which might be considered the basic molecule of which tetraethyl pyrophosphate is an ester) has presented an extremely difficult problem and has occasioned a number of articles in chemical literature (1), (2), (4), (10). The argument has resolved itself into two possible structures, one of which is symmetrical and the other unsymmetrical. Both sides of the argument have adherents and proofs unanswered by the other.

To determine which of the two structures is correct, various salts and esters have been prepared, including the tetraethyl ester (2), (3), (4), (7), (10). As yet no conclusive evidence has been presented for either structure and likewise undetermined is the structure of the tetraethyl ester. Thus either of the following might be the true structure:





Other arrangements of the groups are possible but since this is chiefly of theoretical interest, the subject will be left with only the further comment that one appreciably different structure has been proposed by Reinicke (11). This involves considering the phosphorus atom as the center of a tetrahedron. The structure thus formed defies transcription to paper —a three-dimensional model is the only practical method of visualization.

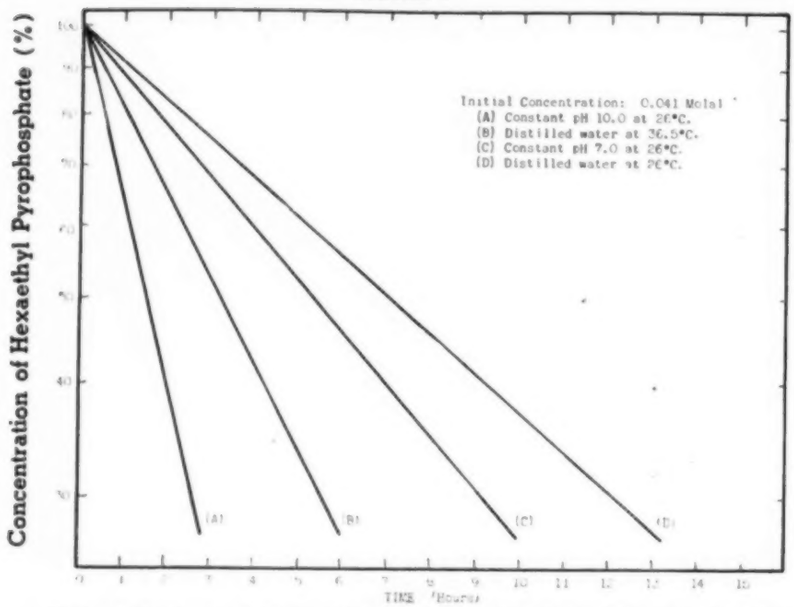
Tetraethyl pyrophosphate can be distilled under vacuum and a purified form prepared. Table I lists briefly the practical physical properties of distilled tetraethyl pyrophosphate. The values given are approximate and do not represent highly accurate laboratory determinations. Generally, the physical and chemical characteristics of tetraethyl pyrophosphate are similar to those of hexaethyl tetraphosphate, but there are some very important differences. Both are hygroscopic liquids hydrolyzing in the presence of moisture to acidic compounds of a lower order of toxicity. However, the decomposition of tetraethyl pyrophosphate proceeds at an appreciably lower rate than that of hexaethyl tetraphosphate, and thus the pyrophosphate retains its activity for a longer period of time in the presence of moisture.

A second major difference between the two esters is the higher vapor pressure of tetraethyl pyro-

TABLE I
Physical Properties

Formula: $(C_2H_5O)_4P_2O_3$ Molec. Weight: 290.20
Spec. Grav. (25°/25°C.): 1.19 Crystal. Point: Below minus 50°C.
Boiling Point (approx.): 100°C. at 0.01 mm. Hg.; 125°C. at 1 mm. Hg.; 150°C. at 10 mm. Hg. Decomposes at higher temperatures.
Refractive Index (N_D^{25}): 1.47
Appearance: Colorless, mobile liquid.
Solubility: Miscible with water, acetone, alcohol, benzene, carbon tetrachloride, chloroform, diacetone alcohol, ethyl acetate, glycerine, orthodichlorobenzene, pine oil, toluene, xylene, alkyl naphthalenes, etc. Not miscible with kerosene, petroleum ether, or other paraffinic oils.

FIGURE 1



The hydrolysis of solutions of tetraethyl pyrophosphate with respect to time under varying conditions of pH and temperature, as adapted from Mangun (8). The concentration of tetraethyl pyrophosphate refers to the non-hydrolyzed portion.

phosphate which, as mentioned above, makes possible its distillation at reasonable pressures. Not only does this property make possible the purification of the chemical but also may well increase its effectiveness as an insecticide because of its greater fumigant action.

In the hydrolysis of hexaethyl tetraphosphate, two molecular equivalents of acid are formed per mole of the ester almost immediately upon the addition of water. A further slow hydrolysis then occurs which results in the detoxification of the solution. Tetraethyl pyrophosphate, on the other hand, does not produce an immediate hydrolysis but slowly hydrolyzes to give, finally, two molecular equivalents of acid for each mole of ester. According to Nylen (10), chiefly diethyl acid phosphate is formed. Again the hydrolysis is accompanied by a gradual decrease in the toxicity of the solution.

Mangun (8), has investigated the hydrolysis of tetraethyl pyrophosphate under varying conditions, and has found that the hydrolysis is a first order reaction which is independent of the initial concentration. Figure 1 is an adaptation of Mangun's data showing the hydrolysis under various conditions. It will be noted that in distilled water the "half-life," or time required to decompose one-half of the tetraethyl pyrophosphate, is approximately seven hours at 26°C. and three hours at 36.5°C.

Since commercial production of tetraethyl pyrophosphate may vary in purity and thus differ in the degree of biological activity, an accurate method of analysis is highly desirable. In the past, biological assays have provided this means of analysis. (It might be noted that distillation is often accompanied by partial decomposition and is, therefore, not sufficiently accurate for an assay.) It has been found that a close correlation exists between insecticidal activity and the toxicity to rats and mice, and these animals as well as insects have been used as the basis of comparative assays. Such assays are, of course, subject to the many variables inherent in biological testing, and a physical or chemical determination, when developed, will have much to recommend it. Work on such a method is under way in several laboratories.

Information on the compatibility of tetraethyl pyrophosphate with commonly used insecticides and fungicides has not yet been published. Predictions, however, may be made based on the chemistry of the compound. It would be expected that tetraethyl pyrophosphate would be compatible with most organic materials such as DDT, chlordane, benzene hexachloride, oils, etc. Organometallic fungicides and "fixed copper" compounds might be considered doubtful; and basic materials such as zinc, calcium and basic lead arsenate and any material containing lime would be expected to be incompatible. Since not all possible combinations have been tested, any recommendation should be validated by actual experimentation.

Insects and Plants

As mentioned earlier, tests which are now under way will give a definitive report on the subject of insecticidal activity in various climates and against many insects.

Ludvik and Decker (6) in their work on the activity of various phosphorus compounds, found that in tests on *Myzus porosus* Sanderson (an aphid occurring on roses) at a dilution of 1:10,000, a 95% kill was obtained, and at 1:40,000 over a 50% kill resulted. In this same series of tests hexaethyl tetraphosphate gave approximately a 90% kill at 1:5,000, and nicotine (95% free base) gave approximately a 50% kill at 1:2,000.

Other tests (unpublished) have shown commercial control of various insects at dilutions of from 1:4,000 to greater than 1:20,000. As with hexaethyl tetraphosphate, tetraethyl pyrophosphate is generally effective against aphids and mites. In particular, promising results have been noted on the two spotted spider mite, green chrysanthemum aphid, pea aphid, green peach aphid, *Myzus porosus*, plum curculio, sweet clover weevil, rose sawfly, and others. On the basis of tests thus far, it would appear that those insects susceptible to hexaethyl tetraphosphate, as well as others, will be susceptible to tetraethyl pyrophosphate.

As may be seen in Figure 1, the hydrolysis of tetraethyl pyrophosphate is quite appreciable within a few hours after dilution, and, as a consequence, it is desirable to use spray solutions as soon as possible.

The addition of a wetting or spreading agent to spray solutions has been found of assistance in wetting the insect.

In addition to insecticidal evaluations of tetraethyl pyrophosphate, tests are presently under way on the use of the chemical as a rodenticide. Extremely small quantities have been found to be effective and the characteristic detoxification through hydrolysis may be a distinct advantage in certain cases. For example, a bait in the presence of air and moisture in a reasonable period of time becomes comparatively nontoxic, or when ingested by a rodent the hydrolysis would render the chemical harmless in the event that the rodent were later eaten by a pet or other animal.

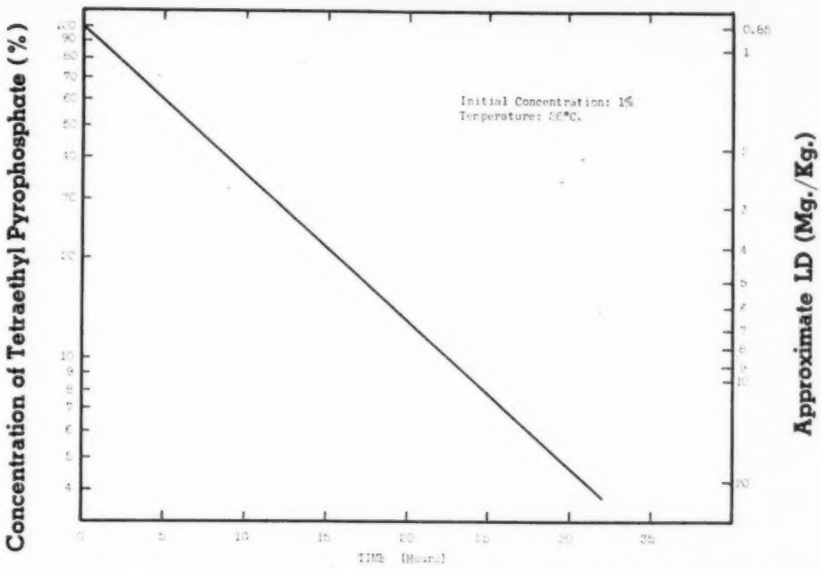
Tests have been conducted to determine possible plant injury, and of those plants tested none showed injury at working concentrations. These plants include: *asparagus springeri plumosa,* broccoli, carnation, cauliflower, chrysanthemum, cucumber, egg plant, fern, pea, poinsettia, rose, snapdragon, soybean, stringbean, tomato. At a dilution of 1:1,000—appreciably stronger than required for control—a slight burn on tomato was noted. Further tests on this subject will be required to circumscribe completely the field of phytotoxicity.

Toxicity and Handling

ACUTE toxicity studies on rats, mice and rabbits have shown that tetraethyl pyrophosphate is extremely poisonous to warm blooded animals when introduced orally or absorbed through the skin. The immediate gross toxicity when administered orally to rats in a water solution is approximately 2 mg./kg. of body weight; by intraperitoneal injection the LD50 to mice is approximately 0.7 mg./kg.; and less than 0.04 ml. will cause death when placed on the abdominal skin of a rabbit. These tests cannot, of course, be extrapolated directly to humans, but certainly a high degree of toxicity may be expected.

As discussed above, in the presence of moisture, tetraethyl pyrophosphate rapidly decreases in toxicity. This decrease is at the same rate as the hydrolysis of the compound, and the curve plotting the percent hydrolysis is practically identical when based on titration as in Figure 1, or when based on the toxicity of the solutions to rats. Figure 2, which is taken from the data of Mangun and Cleveland (9), shows the hydrolysis of a one percent solution of tetraethyl pyrophosphate at room temperature and the concomitant decrease in toxicity. The experimental points which define the curve agree very well when plotted from either method of analysis. It will be noted that in 24 hours, the solution is less than one-tenth as toxic, and if the curve is extrapolated to three days, the solution is approximately one-fifteen-hundredth as toxic. Ultimately, the toxicity of the solution becomes that of the final hydrolysis product.

FIGURE 2



The hydrolysis and concomitant decrease in toxicity of a 1% solution of tetraethyl pyrophosphate with respect to time, as adapted from Mangun and Cleveland (9). The concentration of tetraethyl pyrophosphate refers to the non-hydrolyzed portion, and the approximate LD50 is based on intraperitoneal injection in mice.

The mode of action of tetraethyl pyrophosphate is still under study by a number of investigators and only preliminary reports have appeared. The compound exerts a very profound inhibition on cholinesterase in animal and insect bodies as well as *in vitro* in extremely dilute solutions. When introduced orally in a quantity sufficient to cause death to the test animal the action of tetraehyl pyrophosphate is characterized by hyperexcitability, fine and coarse tremors, dyspnea, extreme miosis, convulsions, collapse and finally respiratory failure.

In field tests with tetraethyl pyrophosphate suitable precautions must be taken to prevent exposure of the operator to the chemical, its solutions or vapors by ingestion, inhalation or skin absorption. The use of protective clothing and masks or respirators to accomplish this purpose is advisable. Any accidental contamination should be removed by the liberal use of soap and water. Adequate care and supervision in experimental work with this chemical, as with any new compound, are requisites in an intelligent and careful test program.

Containers and Equipment

CONTAINER tests have been conducted on a variety of materials to determine satisfactory packaging practices. Tetraethyl pyrophosphate (anhydrous) was found to attack, at an appreciable rate, black iron, galvanized iron and tin plate. Nickel, stainless steel and aluminum showed little or no evidence of attack

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F. A. O. Studies Use of *To Protect* Stored

SCIENTISTS from 25 nations gathered at the Royal Empire Society Building in London August 5 to 12, to discuss control of foodstuffs infestation by insects, fungi, and rodents. Under auspices of the Food and Agriculture Organization of the United Nations, the conference included representatives from Australia, Belgium, Brazil, Canada, Czechoslovakia, Denmark, Dominican Republic, Egypt, El Salvador, Ecuador, France, Greece, Guatemala, Haiti, India, Luxemburg, Netherlands, New Zealand, Norway, Panama, Peru, Poland, Siam, United Kingdom, U. S. A. and Uruguay.

Secretary of the conference was Stephen S. Easter, of the F.A.O., assisted by W. McAuley Gracie and colleagues of the British Ministry of Food. (Infestation Division). Delegates from the U. S. were Dr. Richard T. Cotton and Dr. Ernest A. Back of the U. S. Department of Agriculture. Papers by other Americans were also included on the agenda.

The conference opened with reports on the amount of food wasted annually by insects and other pests, a study of how such pests are disseminated throughout the world, and a number of papers on specific aspects and their control. These included talks on rodents, fungi, insects, and a discussion of the world supply of control materials. Presented also were papers on application equipment, and one on the need for further research.

The following abstracts of papers dealing with control problems should be of interest to persons in the agricultural chemical field:

"WORLD FOCI OF INFECTION AND PRINCIPAL CHANNELS OF DISSEMINATION . . ." (Dr. John A. Freeman, Infestation Division, U.K. Ministry of Food.) As one of the introductory papers, it outlined the overall picture given by sampling susceptible produce imported into the U.K. from other parts of the world. A list of the most common insects found in imported produce was given (*Tribolium castaneum* 58%, *Ephestia cautella* 37%, *Necrobia* spp. 33% (chiefly on oilseeds and bones), *Tenebroides mauritanicus* 32% and *Laemophloeus spp.* 25%.) The most heavily infested commodities are received by the U.K. from South America, tropical Africa, India, Burma, Malaya and the Pacific Islands. The least infested commodities are received from Canada, U.S.A. (except Southern ports), Australia and New Zealand. The total U. S. figures are commendably low, but it is significant to note that "many of the species included in the totals recorded on U.S.A. and Canadian produce were due to residual infestations in the ships, following the carriage of infested commodities from other countries." (This would seem to imply a need for the wider and more effective use of pesticides by shipping companies.)

Dr. Freeman's paper also covered the analysis of commodity infestation, the separate parts played by land and sea carriage in promoting infestation, and arrangements for detecting and controlling infestation. Two of the most difficult domestic insects to control effectively aboard ships are the cockroach and pharaoh's ant. These insects have not only been found in the accommodation of ships but also in the cargo on which they may be readily carried into warehouses on land, where they soon find suitable breeding places.

No actual suggestions for pest-killing are given, but agriculturists may be interested in the fact that the carbon dioxide test (Oxley and Howe: *Bull. Ent. Res.* vol. 35, 1, April 1944) is recommended as a preliminary to possible fumigation of bulk grain. The rapid appraisal of moisture content by using cobalt thiocyanate papers (Solomon: *Ann. Appl. Biol.* vol. 32, 1, pp. 75-85) is also recommended as a preliminary.

"PRESERVATION OF GRAINS AND CEREAL PRODUCTS IN STORAGE FROM INSECT ATTACK" (Dr. R. T. Cotton, U. S. Dept. of Agriculture, Bureau of Entomology and Plant Quarantine, and Dr. H. E. Gray, Entomology Branch, Canadian Dept. of Agriculture.) This paper listed the common insect pests of stored cereal products and also those beneficial insects (e.g. the small wasps *Aplastomorpha calandrae* and *microbracon hebetor*) that feed on such pests and do not themselves damage the grain. The paper also details control and inspection methods, and emphasizes the value of "good housekeeping." The following notes give some idea of the scope covered in the paper:

Contact Toxicants & Aerosols

BOTH contact insecticides and aerosols are effective against insects, such as the Indian meal moth, which causes surface infestations.

CHEMICALS of Foods

Extract of pyrethrum (total pyrethrins not less than 0.8 percent) in a high grade oil carrier is a very satisfactory contact spray when applied by means of an electric sprayer. It should be applied at the rate of approximately 6 ounces per 1,000 cubic feet of space above the grain in closed-top bins. The dosage should be increased to 8 ounces in the case of open-top bins.

Excellent kills are obtained by the use of pyrethrum aerosols when used at the rate of 1 to 1.5 ounces per 1,000 cubic feet of space above the binned grain. Specially refined pyrethrum is used, and the aerosol contains approximately 5% of pyrethrum. "Freon 12" under pressure disperses the pyrethrum which remains in the air as finely divided solid particles.

The contact spray and aerosol method of controlling surface infestation is both cheap and effective. The principal drawback is the necessity for repetition at frequent intervals, as the toxic material can reach only those insects which are at or above grain surface. Persistence in treatment, particularly when the larvae come to the grain surface prior to pupation, will control pests such as the Indian meal moth.

Residual Sprays

RESIDUAL type sprays have not proved to be of much value against insects causing surface infestations, when applied to the ceiling and upper portion of the walls of concrete closed-top bins. In the filling of a silo type bin, a deposit of dust is often laid down on the exposed surfaces above the grain level, which covers the toxic deposit and renders it ineffective.

In wooden bins the use of a residual spray after cleaning and before filling the bin will do much to reduce populations of cadelles and other insects which burrow into or hide in the woodwork.

Fumigation

FUMIGATION may be defined as the treatment of a commodity or space with a gaseous material to kill the insect pests in it. Because of the ability of certain fumigants to penetrate deeply and kill insects within large masses of food-stuffs, these insecticides are of great value in protecting stored foods. From the materials now available it is possible to choose one suited to the commodity, conditions of storage, and the insect pest involved. To be successful, the fumigant must be maintained at a sufficiently high concentration for a long enough period of time to kill the pest.

The gas concentration within the treated space is affected by a number of considerations: (1) tightness of the building, (2) atmospheric conditions at the time of fumigation, (3) distribution of the fumigant, (4) nature of the commodity, (5) methods of packaging, and (6) method of piling.

A table of Fumigant Dosages for the treatment of grain stored in steel bins is quoted from *Agricultural Chemicals* (December, 1946: Cotton, R. T. and Walkden, J. H. "Fumigation of Grain and Other Stored Foods.")

Transportation and warehousing problems are discussed in this paper, as is a more specialized appeal to agriculturists, dealing with the protection of stored seed from insect damage. Many of the insect pests of stored grain prefer the germ of the seed as food, hence their chief damage is to the viability of the seed. To preserve the viability of seed for the longest possible time, it should be kept in a dormant condition. The same factors that speed up the life processes of the seed affect the seed-infesting insects similarly. Within certain limits, the higher the moisture content of the seed and the higher the temperature, the faster these insects reproduce. Seed that is cool, dry and free from dockage (dust or broken kernels) is unfavorable for insect development.

Fumigants, Dusts, etc.

FUMIGATION offers a rapid and effective method of destroying insects in stored seed. If proper precautions are taken, no damage to germination need be feared. Under certain circumstances, however, most fumigants are likely to lower the viability of some types of seed. If seed moisture is over 12 percent or if the dosage or the exposure period is excessive, many fumigants will cause injury. Exposure periods should not exceed 24 hours. If bulk seed is treated, provision must be made to aerate it after 24 hours unless the fumigant used is known to be harmless under all conditions. Most bulk seed has the faculty of absorbing and retaining fumigants for long periods, therefore, unless it is aerated the exposure period is automatically extended and serious germ injury may result.

Naphthalene and paradichlorbenzene crystals have been used extensively for the protection of seed. According to Cotton and Gray, the popular dose of 1 ounce of crystals per bushel is more than sufficient to supply a saturated atmosphere of these fumigants in treated seed.

Of the several methods available for protecting seed from insect attack, mixing seed with a dust pro-

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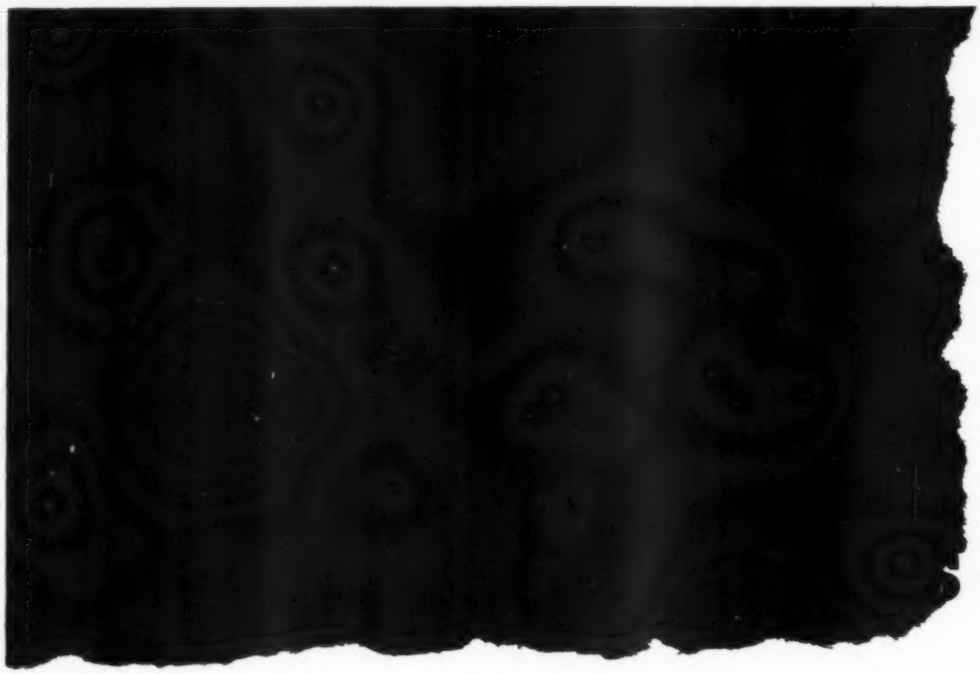

112th

NUMEROUS papers dealing with chemicals in the agricultural field were presented at the 112th meeting of the American Chemical Society held at the Pennsylvania Hotel, New York, September 15 to 19. Subjects included insecticides, weed killers, fungicides, and fertilizer materials. A symposium on insecticides in food production under the chairmanship of R. C. Roark of the U. S. Department of Agriculture, was an outstanding event. Some 23 papers were presented by speakers representing industry, federal agencies, and agricultural experiment stations. L. S. Hitchner, executive secretary of the A.I.F.A. discussed the industry and its contribution to food production. He pointed out the almost limitless world market for pesticides, and added that because of our knowledge and production facilities, the U. S. will be expected to supply much of the world's insecticide requirements. Also mentioned were new materials coming into the picture, including weed-killers, defoliants, plant hormones, soil and seed treatments, rodenticides and techniques in protection of livestock from insect pests.

Dr. F. C. Bishopp, Bureau of Entomology and Plant Quarantine, U.S.D.A., discussed the use of insecticides on livestock. He said that pyrethrum gives a quick knock-down effect on flies on stock or in barns, but that it provides little residual effect. DDT on the other hand is being used extensively for control of horn fly and stable fly. Its residual action against most species of flies was described as "remarkable." Discovery of various chlorinated materials has proved useful against such pests as mites, ticks, fleas, biting and sucking lice, sheep ticks, sand flies and mosquitos in addition to various flies. Control of horse flies, deer flies and screwworms has proved difficult, he said.

The use of insecticides for protecting growing crops was discussed by Dr. Bailey B. Pepper, New Jersey Agricultural Experiment Station, New Brunswick, N. J. He said that the efficiency of new insecticides has further emphasized tremendous crop losses caused by insects, and stated that previous estimates on such losses have been much too low. Newer insecticides are specific for certain species of insects, and some of the newer products show toxicity to some plants. There is also the question of animal toxicity which needs careful evaluation before new materials can be recommended. This has a bearing on chemical residue on crops at harvest. Chemical pest control is becoming more precise and specialized, requiring the assistance of chemists, toxicologists, and physiologists. The entomologist, he said, must re-educate the user of insecticides to the new concepts of chemicals for pest control.

J. C. Frankenfeld, Agricultural Research Administration of the B.E.P.Q. in presenting his paper on "Insecticides on Stored Products," described the functions of three types of materials used. These are fumigants, sprays and dusts. Fumigants were listed in these groups: those highly toxic, used for rapid kill, such as hydrocyanic acid gas; those which act more slowly but are effective for a longer time; and those used in treating products stored in tight containers to provide protection for an indefinite period. These materials must leave no harmful residues in the product treated, must not affect the future processing or handling of the product, and must assure a high degree of control. Development of residual sprays promises control, and dusts of both inert and active types are coming into use. A number of factors enter into the choice of insecticide. These include the product itself, the use to be made of it, length of storage period, type of storage, species of insects, and temperature and humidity of the air and product.

A paper on "Inorganic Insecticides" was presented by L. B. Norton of Cornell University. Knowledge of the chemistry of inorganic insecticides is of particular importance in minimizing toxicity to plants and animals, he said. This is especially true as it concerns toxicity to humans and the narrow margin between toxicity to the insect and injury to

Meeting

the plant. The margin of safety to plants has been increased by careful attention to composition and to reactions with other pest control constituents, and by the use of "safeners" to reduce solubility. In some cases, he said, the inorganic insecticides are still preferred to newer organic materials.

Rotenone, pyrethrum, nicotine and other organics were discussed in a paper "Insecticides Derived from Plants" by E. J. Seiferle and D. E. H. Frear of Pennsylvania State College. The paper explained the action of various insecticides of this type, and pointed out that rotenone and pyrethrin insecticides are relatively non-toxic to warm-blooded animals. Other plants showing promise are sabadilla seed, *Ryania*, and the yam bean, he said.

Possibility of the use of DDT as an insecticide on food products for man and on forage crops was discussed by O. Garth Fitzhugh of the Division of Pharmacology, Food and Drug Administration. He pointed out the dangers of such use since DDT accumulates in the fatty tissues of animals, and man consumes enormous quantities of milk, butter, meat, fat and eggs. The problem of DDT in animal food thus enters into the human consumption problem. There are also wide individual variations within a given animal species in susceptibility to poisoning. Since this has been observed in all animal species, it is assumed to be true in man, also. Experiments on rats show that doses of 10 ppm result in measurable storage of DDT in fat, and that 50 ppm of DDT in the diet markedly reduce the number of young in the second generation. No effect on reproduction occurred with 10 ppm of DDT.

"The Role of Surface-Active Agents in Foliage Sprays" was discussed by Dr. Frank Wilcoxon, American Cyanamid Co. He pointed out three ways in which "wetters," "spreaders," and "stickers" are important supplements to insecticidal and fungicidal sprays. They aid in emulsifying the liquid, in enabling the spray to wet leaves and insects, and in affecting the resistance of the spray deposit to rain and weathering.

Robert D. Glasgow, New York State Science Service described old and new methods of applying insecticides. He reviewed the history of insecticide application, tracing the development from the use of primitive methods to the present-day practice of application by airplane, fog machines, and aerosols.

"Biological Methods of Testing Insecticides" were discussed in a paper by Harold H. Shepard, Insecticide Testing Laboratory, Insecticide Division, Livestock Branch, Production and Marketing Administration. He stated that "tens of thousands" of new organic compounds are being screened for possible insecticidal value. More refined biological methods are utilized to determine specific uses and efficient formulations, and more elaborate methods are applied to the study of mode of action for a better understanding of the types of compounds which should be insecticidal. Standardized biological methods are the basis of commercial and governmental quality control.

M. D. Farrar, Crop Protection Institute, Durham, N. H., presented a paper on "Relation of Chemical Research Laboratories to the Development of New Insecticides and Fungicides." He told how the manufacturers of chemicals have given strong support to the development of pesticides through the support of grants and fellowships at research institutes, colleges, and in industry. He said that the screening of unknown chemicals by laboratory techniques has become a major project with many companies, and that from these programs have come the new organic insecticides and fungicides.

Hazards arising from residues of DDT in agricultural products was pointed out by R. H. Carter, Agricultural Research Administration, U.S.D.A., in his paper on the subject. As had been pointed out in a previous paper, DDT accumulates in animal fatty tissues. The amount of accumulation is determined chemically by a colorimetric method in addition to basing such determination on the total or labile chlorine content. DDT has been found in the fat and in the milk of beef and dairy cattle receiving forage containing insecticidal residues of DDT, and the milk from cows which had been sprayed with it. The cooking of meat containing DDT did not cause complete decomposition of the compound as evidenced by characteristic color reactions.

Along the general theme of the above paper, Henry A. Lardy of the University of Wisconsin told of studies made of the possible hazards arising from the use of DDT insecticides on canning peas and sweet corn, by-products of which are commonly used as livestock feed. His paper, "Experiments with Silages from Pea Vines and Corn Stover treated with DDT Insecticides" presented figures indicating that silages made from both pea vines and corn showed 30 to 60 percent decreases in their DDT contents during fermentation and storage. Very little DDT was found in the fat of lambs and ewes given DDT-treated corn silage in a prolonged feeding, but the fat of steers in the same experiment showed appreciable levels of DDT. None of the animals had appreciable levels of DDT in muscle tissue.

"The Metabolism of DDT and Related Chlorinated Compounds" was described in a paper by Geoffrey Woodard, Bernard Davidow, and Arthur J. Lehman, Food and Drug Administration. It was pointed out

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By Dr. P. N. Annand*

Chief, Bureau of Entomology and Plant Quarantine, U.S.D.A.

INSECTICIDES

ANNOUNCEMENTS of new insecticides for which special merit is claimed have become almost commonplace since the war. Many of these materials have undoubted value, and require only careful evaluation and study before they take their proper place in the field. Others will fall by the wayside because of ineffectiveness, or because of being too toxic to man, animals or plants. Still others will be too costly to survive in competition.

In the past, new materials were accepted slowly, allowing time for careful testing on a small scale. Now, however, new materials are being readily accepted by growers, some of whom are using them on a large scale without adequate information on their effectiveness, on proper dosages and formulations, and on the hazards to man, crops, soils, livestock and wildlife.

This accelerated program, accompanied with wide publicity regarding war-developed insecticides, particularly DDT, has convinced the public that there are available new materials which far exceed in effectiveness the remedies formerly used. The public has also come to demand a higher degree of control than it has accepted in the past. Insecticide shortages and the high value of farm crops have stimulated demand for new materials, particularly for aphicides and for cotton insect control. Higher expenditures for insecticides have proved profitable, which has encouraged thorough control with the best materials available. The continued urge for maximum production has influenced insecticide usage. Both the grower and the public are impressed by the scientific achievements made during the war period. Not infrequently, the mere fact that an insecticide is new, seems to enhance its value and desirability to the buyer.

General interest in new insecticide development has resulted in greater production than ever before of chemicals having insecticidal properties. Competition has been important in urging rapid development of such materials, and their early release to the public. It may be stated, however, that a great deal of responsibility has been shown by industry in general, in developing facts regarding new materials before release. The research facilities of industry are greatly expanded, and extensive cooperation has been carried on with Federal, State and private research agencies. In spite of this, however, there is the usual tendency in certain segments of the industry to push materials faster than facts justify.

Lack of background knowledge presents special difficulties in evaluating highly complex organic compounds now being found to have insecticidal value. The pre-evaluation of possible hazards is difficult because even methods for analysis must often be worked out and may involve considerable study and some controversy before the method is finally accepted for application to problems of residue, formulation, absorption, excretion, etc.

Research

MANY of the difficulties in establishing the value and safety of new materials stem from the length of time required to complete dependable research. The work not only of entomologists is required, but also of toxicologists, pharmacologists, veterinarians, chemists, agronomists, plant physiologists, soil specialists, and others. However, if recommendations for public use were to await all of the desirable research data on all possible applications of the material, there would be no recommendations for most materials in the foreseeable future. The procedure for release of most materials must for many years be one of limited recommendation. New insecticides should be recommended only for specific purposes and these expanded as sound data justifying additional uses become available. Broad general recommendations may have to be followed by restrictions later as information develops.

It is an enormous task to supply scientifically supported facts for the sound development of chemical control of insects. The field continues to expand rapidly as new and strange chemicals continue to be found. It is a task which can not be accomplished with desirable accuracy and dispatch by State and Federal research facilities alone. The expansion of research facilities in industry is a welcome addition to those now available. It is my hope that the present trend toward close cooperation between

* Paper presented at 14th Annual Convention, A.I.F. Association, Spring Lake, N. J., September 3, 1947.

The general use of new insecticides is creating problems which demand cooperation of government agencies and industry more than ever before

governmental and industrial research may continue.

The primary responsibility of the Bureau of Entomology and Plant Quarantine toward the public is to find effective, cheap, and safe methods for insect control. If these methods involve insecticides, the Bureau is interested in no particular products, but only in finding the ones, irrespective of manufacture, which most nearly meet the users' requirements. Its interest is in the end result rather than the method or material used. The Bureau greatly expanded its work of initial testing of chemicals during the war. It will probably always be necessary for the Bureau to do a certain amout of such work as it is recognized that worthy materials may be obtained from sources other than industrial laboratories. It is not proposed that entire reliance will be placed on materials from that source. The Bureau, however, will depend more and more on industrial laboratories to supply materials which have already been proven to have insecticidal properties; materials on which at least some preliminary information on potency, dosage, formulaton and toxicity to humans has been developed. The Bureau will continue to be interested in evaluating materials on a comparative basis to determine relative effectiveness under conditions of practical use, against specific insects, and in developing most effective methods of use.

The primary interest of the industrial laboratory worker must be in certain rather specific chemicals or groups of materials. His basic interest is in developing and finding a place for materials which are or may be produced by the company. This difference in outlook may give some weight to the thought that industrial laboratories will contribute more as time goes on to the time-consuming preliminary testing of materials and their early evaluation.

In spite of the number of new materials and the multitude of different kinds of insect pests and of crops affected, the rate of progress in research on toxicity of the new materials has been reasonably good. The interest in new materials and the superiority of a number of them have resulted in the rapid shift to them away from research on older materials, and away from research on methods of control not involving insecticides. The combined facilities of industrial, State, and Federal laboratories and field stations offer much greater opportunity for evaluating rapidly the entomological possibilities and limitations of materials than opportunities existing for other phases. Even the entomological aspects, however, can not be fully appraised for a given insect species without time for testing under the climatic conditions of several seasons at a given locality and for repeated trials in various regions having different climatological and ecological characteristics. The mere demonstration of high toxicity in laboratory or field must be followed by determination of minimum field dosages, best formulations and application schedules, and relative effectiveness under field conditions as compared with other materials. Time is a factor which can not be reduced below a certain point.

Public Health Problems

EVEN though entomological evaluation can move relatively rapidly, recommendations for general use can not be made until other problems are solved, particularly those affecting public health. As usage of toxic material is expanded, the possible effects on human health must be considered on both a short and long-term basis on foods bearing insecticide residues. This is most important in determining the extent to which new materials should be used. Also to be evaluated is the effect on personnel engaged in applying such materials. Lack of background knowledge on the toxicology of many new insecticides makes it necessary to start investigations at the beginning, experimenting with lower animals and drawing analogies as to the probable effect on humans. Close cooperation has been developed between the BEPQ, the U. S. Public Health Service and the Food and Drug Administration in this connection. The Bureau has attempted to keep these agencies informed of the development of new materials, and to encourage early investigations of these products. Certain materials of poisonous nature have thus been eliminated early.

While acute toxicity may be evaluated relatively quickly, a much longer period is required to determine accumulative dangers through contamination of food where small quantities are involved. Where insecticides have wide application to a large variety of food products, smaller quantities become of greater importance than those to be used in a rather restricted manner. Government laboratories are adequate to provide immediate testing of new materials on only a preliminary basis. Utilization by industry of private toxicological laboratories on a larger scale might speed up the process of evaluation somewhat. However, information on

hazards to human health does not yet permit unqualified recommendations even for some older materials, including DDT, where possible contamination of food is involved.

Dangers to Livestock

TOXICITY to livestock is another factor which affects the problem of finding the value of new materials. The determination of toxicity to animals is relatively easy because the animals themselves can be fed the toxicant directly. The sacrifice of a number of animals may be necessary, and for the larger animals this is rather costly. However, a number of the state experiment stations, as well as the Department, have conducted some work of this kind with certain new materials. The discovery that DDT accumulates in the tissues of animals when fed on contaminated forage and that it is excreted in the milk has made it necessary to determine the extent to which this occurs in the use of many of the new materials, particularly chlorine compounds, before their safety can be fully determined.

Soil and Plant Hazards

A CONSIDERABLE amount of evidence shows that some of the new materials are toxic to soils. The accumulation of such toxicants in the soil due to repeated applications must be considered for all of the new materials. It would appear that those insecticides which are the most stable are most hazardous. There seems to be a rather wide variation in the susceptibility of plants to injury by various insecticides, and the threshold of injury is reached much earlier in certain types of soils than in others. There also appears to be a variation in some cases due to climatic factors including both temperature and rainfall. These facts caution against reaching too sweeping conclusions about the safety of any of the materials until they have been tried on a wide variety of plants under a number of climatic conditions, soil types, and cropping practices. It is the opinion of the Bureau that all materials should be used at the minimum effective dosage until the possible hazards due to accumulations in soils have been fully evaluated, and that farmers should be cautioned against over-application.

There is a suspicion that some of the new materials act as plant hormones, with some observations indicating a direct stimulation of plant growth. The effects of some of these materials have been to distort and stunt plants in a given variety even where other varieties of the same species are apparently not affected at all. The lack of any apparent damage, such as leaf spotting or distortion, is not always adequate for the detection of adverse effects upon the plants. More extensive participation by agronomists and plant physiologists in determining the total effect of the insecticides in terms of yield and quality would contribute much to a more rapid solution of this problem with reference to all of the new organic materials.

Beneficial Insects Affected

THERE has been a good deal of discussion about the hazards of general application of DDT and similar materials because of fear that its potency would eliminate parasites and other beneficial insects and result in outbreaks of pests ordinarily held in check by them. Although this fear may have been overemphasized by some, we now have a number of examples where reduction of parasites due to insecticides has had this effect. The increase of red-banded leafroller in the Ohio River Valley and the occurrence of outbreaks of red spiders, mites and aphids in various locations following the application of DDT are illustrations. The widespread use of DDT in forest insect control has not resulted, in any serious outbreak of pests ordinarily held in control by natural enemies. Although there has frequently been heavy mortality of parasites as a result of insecticide application, the areas appear to have repopulated quickly. In most cases the control operations have been small enough that beneficial insects could move in from margins of the areas treated and the applications have been infrequent. This whole problem is extremely complicated involving a careful evaluation of the entire ecological complex as it may be affected by both the pest species and its enemies. As time goes on it may be necessary to select insecticides having a minimum destructive effect on parasitic and predatory species.

The effect of new materials on honey bees has caused concern not only to beekeepers, but to agriculturists who require honey bees for the pollination of their crops. Little is known about the importance which most of the new materials may assume as bee killers when applied on a large-scale basis. Some of them on small-scale laboratory tests are highly toxic. It was found, however, that DDT was quite toxic to bees under laboratory conditions but that it resulted in much less damage when applied in the field than was the case with arsenicals. In fact, its use has been considered a boon by some of the beekeepers in areas in which serious losses due to arsenical poisoning occured in the past. There is now considerable fear of the introduction and general use of chlordane and chlorinated camphene into some of the beekeeping areas where DDT is now being widely used without serious bee loss. Data on the effect on bees should be obtained for each of the new materials which show a prospect of adoption for the control of insects on important honey plants or on crops requiring bees for pollination.

There are problems involving the effect of new insecticidal materials on wildlife and fish and on soil fauna and flora which will not be discussed but which deserve investigation.

Special Study of Toxicity

A COOPERATIVE project to study the toxicity of new insecticides to animals is now being organized through funds appropriated under the Research and Marketing Act to the Department of Agriculture. Funds will not be available to include all of the new materials in the initial study. It is proposed in the insecticide phases of the work, however, to subject 3 or 4 of the new materials which are furthest along in their development to intensive study relative to their effect on livestock. This should help

to obtain answers to some of the questions which are now hampering the ability of responsible agencies to make sound recommendations for the use of these materials on a large scale either for the treatment of livestock directly or for the treatment of forage on which they feed. This project is getting under way immediately and it will provide for work which has not been previously provided for in funds available to the Department.

Methods of Analysis

ONE of the handicaps to rapid establishment of the value of chemicals as insecticides is the difficulty in obtaining comparable chemical analyses. Early solution of problems of analysis can be hastened by a cooperative attack. It is thought that the Burean can aid in developing accepted methods through stimulating cooperative studies such as has been done recently in the case of benzene hexachloride.

At a conference of technical representatives of Government and industry, it was agreed that one way to attain the objective would be to provide for an exchange of samples and the results of various methods of anaysis of such samples. Four methods of analysis were selected by agreement for primary attention. Upon request the Bureau of Entomology and Plant Quartine agreed to receive samples and to distribute them under code numbers to those willing to participate, to receive and compile the results, and to send copies to each of the participants. This study is now under way.

Insecticide Drift

THE drifting of insecticides, from one property to another is becoming increasingly troublesome. Some states have passed or are considering legislation designed to place responsibility for damage resulting from such drifting and to provide means for regulating insect control practices through which one property owner may endanger the property of a neighbor. The contamination of crops growing on adjacent property, the poisoning of livestock, and the destruction of bees are hazards which are not limited by any means to new materials, but they must be increasingly considered with particular reference to the new materials about which relatively little is known. Damage to bee colonies as a result of dusting for insect suppression has been a subject of controversy in a number of States where heavy losses to bees have occurred. In some states the beekeepers and the crop producers, in some cases stimulated by law suits, have attemped to work out the problem to the benefit of both. Notification of beekeepers in advance of proposed spraying or dusting operations, the timing of control to avoid blooming periods, the use of distribution equipment causing the minimum of drift and the adoption of insecticides having the least potential danger to bees offer means of alleviating the trouble. Possibly the increased utilization of sprays rather than dusts from planes will aid in reducing the drift from field to field, and other methods including different carriers and formulations and improved ground equipment may offer at least a partial solution. Little research on methods to ameliorate hazards of drift is being conducted by any agency. This problem is one which is likely to increase with the wider use of insecticides.

New Chemical Names

THE complicated chemical nature of many of the insecticides and their complicated technical names have raised difficulties not only in publication of technical articles on these materials but also in advertising the products and in labeling them to meet the requirements of the Insecticide Act. The unpronounceability for the layman of many of the chemical names and the inability on the part of most of us to remember them have resulted in a variety of common and trade names which have introduced confusion upon confusion. Some of the designations which have been adopted in general practice have objections because of their great similarity. One needs to think only of the number of pesticides designated by some combination of the letter "D" to realize the possibilities of error and the difficulty in keeping the various letter combinations straight. We now have DDT, DD, DDD, 2-4-D, PDB, TDE, and a number of others which are creeping into the literature. Objections have been raised to both the lettered and numbered compounds because of the difficulty in referring to them in bibliographies and catalogues. The same compound may travel under trade names, numbers and letters, and two or three versions of the simplified chemical designations. We find, for example benzene hexachloride, hexachlorocyclohexane BHC, "666," and Gammexane used irrespective of whether reference is made to the chemical as such or to some formulated insecticide made from the chemical.

Some of the chemical designations are so cumbersome that they are not suitable for including in ingredient labels for proprietary and commercial materials. As the number of new compounds increases, the nomenclatorial problem is further complicated. In the process of reporting preliminary or early tests a number of different types of designations appear in the literature simply because it is not practicable to use the full chemical designation repeatedly in the reports on the results. The American Association of Economic Entomologists at its last meeting authorized its Committee on Insecticide Terminology to cooperate with the American Chemical Society and other interested agencies, such as associations representing insecticide manufacturers and regulatory agencies engaged in enforcing Federal and State laws, in proposing suitable names for unwieldy chemical names and trade mark names. This indicates the general interest, at least on the part of entomologists, in developing a sound insecticide terminology which will avoid the multiplicity of names for each compound and will avoid confusion.

The Inter-Departmental Committee on Pest Control has given consideration to this problem and is attempting to obtain a unified practice among the Government agencies with reference to at least certain of the new chemical materials. As an outcome of this effort it was agreed that

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the use of the long, exact chemical name for the compound now generally known as Chlordane was generally impracticable and undesirable. It was agreed to propose and recommend the use of a short common name as a substitute which would be defined and and recorded with the United States Patent Office to preempt its use as a trade mark name. It was further agreed that the name and definition would be submitted to interested organizations, particularly to the AAEE with the recommendation that it adopt the name as standard. As a result of this conference Chlordane was adopted for the chemical known as 1, 2, 4, 5, 6, 7, 8, 8 — octachloro — 4, 7 — methano — 3a, 4, 7, 7a, — tetrahydroindan, which was being offered for sale under the trade names of "Velsicol 1068" and "Octa-Klor." This common name has now been recorded at the U. S. Patent Office at the request of the Department of Agriculture so that it is reserved for application only to this material; and use of this name and of the name "technical Chlordane" has been approved for labeling commercial insecticides containing the product to meet requirements for interstate movement. Other organic insecticides are being considered for similar treatment. It is a process which is similar to practices now established for providing common or trivial names for drug products. I believe that such simple designations would be in the interest of the manufacturer as well as of the public. It is of interest to note that the Federal Insecticide, Fungicide and Rodenticide Act, passed during the last session of Congress, contains a provision that the Secretary of Agriculture is authorized to make rules and regulations for determining and establishing suitable names to be used in the ingredient statement.

Methods of Application

DEVELOPMENTS in new insecticides have been paralleled by developments in methods of application, which are also having important influences on the wide-scale use of insecticides. Many of these new methods are not yet in general use, a number being still in the experimental stage. Some of these equipment developments have been made possible through the greater potency of new insecticides, and like the chemicals themselves, hold promise of making a major contribution to insect control. They are opening new areas for chemical control and are already greatly expanding the field for insecticidal application. Control of a tussock moth infestation in the

Application methods are greatly improved . . . but drift must be controlled . . . new hazards appear as field expands . . . simpler insecticide names needed

Douglas fir forests in the northwest this season illustrates. Some 413,000 acres of fir forests were involved in mountainous terrain which could be reached only by air. Had not the new insecticides been available, and the means to apply them, control would have been impossible. DDT was applied at one pound per gallon of solvent at a dosage of less than a gallon per acre (390,881 gallons for 413,469 acres), with what appears at this time to have been completely satisfactory results. One C-47, 2 Tri-motored Fords, and 8 to 12 smaller craft were used during the operation, which required a total of 42 days including non-flying time because of bad weather. The performance of the large planes was of special interest; swath width for the C-47 was approximately 400 feet. It carried one thousand gallons per trip enabling it to cover on each flight in excess of one thousand acres. The Tri-motored Fords carried 800 gallons per trip and were particulary maneuverable and dependable. The cost for materials and flying approximated $1.29 per acre. This cost can probably be reduced in the future.

Similar operations have been conducted in Pennsylvania and New York to control gypsy moths during the past few years. In 1947, 106,737 acres were sprayed from the air with excellent results. These and similar control projects have fully established spraying by air as a means of control of important defoliators of forests and are opening up an extensive field for insecticide use.

Mist blowers of various types are being used to apply insecticides in concentrated form for control of insects attacking city shade trees and for other special uses. In 1947, 54,000 acres were treated by such blowers for gypsy moth to supplement control by air. Smokes or fogs and aerosols are receiving much attention as a means of insecticide distribution.

While opening up new fields of insecticide use and while improving and cheapening insect control, these new methods may also increase hazards if improperly used. They may be inclined to encourage promiscuous distribution of toxicants without due consideration of the effect on beneficial insects and wildlife. The use of fogs presents unusual problems in drift although these may be no more serious than those we have now when using dusts from planes.

Only a few of the problems associated with development of new insecticidal materials have been mentioned and a number of them have been treated very incompletely. Not all of them have been mentioned, but by tomorrow or the next day there will probably be additional ones not even known now. To a very large extent the field is uncharted and the way will be strewn with obstacles and difficulties, the removal of which will require the best efforts of the representatives of various scientific specialties involved, as well as the fullest cooperation between research and industry. The rate of advance in terms of past experience has been exceptionally fast. In terms of demand from the public and their impatience to have immediate results, it has been very slow. The continued cooperation from industry and the appreciation which such a large segment of it has of the difficulties involved and of its responsibility will aid in the more rapid solution of many of these problems to the final benefit of the consuming public.★★

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London Conference Discusses*

FERTILIZERS

By J. M. Vallance

PART II

FERTILIZER AMMONIUM SULFATE CRYSTALS. *By John Manning,* Billingham, England. Ammonium Sulfate is applied directly to the land by farmers and it is therefore desirable to have the sulfate in a form which can be readily distributed.

The caking of sulfate is caused by the sticking-together of sulfate crystals at their points of contact by a cement produced by the drying of a saturated solution of ammonium sulfate on the crystals. The degree of caking depends under given conditions on the surface of the crystals, their impurities and size and shape. It is the size and shape that are here considered.

The original synthetic ammonium sulfate consisted of small cube-like crystals similar to sugar crystals. A new type which has been developed is cigar-shaped and very much larger. There are fewer points of contact between the crystals both on account of their size and shape and caking is now very much less.

These crystals are produced in an acid solution containing a trivalent ion and are grown to a suitable size by keeping the crystals for sufficiently long time in contact with a supersaturated ammonium sulfate solution.

THE SOIL AND ANIMAL HEALTH. *By James Stewart,* Moredun Institute, Edinburgh. Mineral deficiencies of the soil and appropriate treatment by soil dressings are discussed. The author mentions the "small but very vociferous" body of non-scientific opinion which seeks to prevent the use of artificial manure, asserting that such manures produce crops of such inferior quality as to affect seriously both animals and humans who feed on them. It is pointed out that any such campaign against the use of artificial manure might seriously endanger the health of much livestock, especially in those areas where deficiencies of either major or minor elements in the soil exist.

PLACEMENT OF MINERAL NUTRIENTS IN SOILS. *By A. B. Stewart,* Macaulay Institute for Soil Research, Aberdeen, Scotland. Section 5. The percentage of utilization of plants of mineral nutrients applied as fertilizer supplements varies with soil conditions and with the solubility and other properties of the elements involved. Most inorganic forms of nitrogen are readily soluble and mobile in soil and are, therefore, relatively accessible to plant roots. On the other hand, phosphates, which quickly form insoluble compounds, tend to remain where they are placed in soil and have a low percentage utilization. Similar considerations apply to other major and to trace element supplements commonly required to counteract specific deficiencies. Some can be applied directly as fertilizers (e.g. boron) while for others (e.g. iron) such methods as spraying foliage with nutrient solutions may be more practicable.

The most common method of applying a mineral supplement to a soil is to broadcast it over the surface, but there are sound theoretical reasons why such supplements as phosphates are likely to be more effective when placed close to the seed than when they are broadcast and more or less uniformly incorporated with the soil.

TRACE CONSTITUENTS OF THE SOIL. *By R. L. Mitchell,* Macauley Institute for Soil Research, Aberdeen. The approximate total content of any trace constituent in a soil may often be anticipated if the geological origin of the parent soil material is known. With soils derived from igneous rocks in particular this is so, although it is more difficult with metamorphic or sedimentary rocks.

Many so-called trace element deficiencies are not due to any lack of the trace constituent in the soil, but to the medium being unfavorable to uptake by the plant, for instance because of the presence of free lime raising the pH above neutrality. The pH of the soil is, for many trace constituents, more important than the actual amount of trace constituent as far as plant uptake is concerned.

ION-EXCHANGE MATERIALS AS SOURCES OF PLANT NUTRIENTS. *By Daniel D. Arnon,* Division of Plant Nutrition, University of California, Berkeley. An investigation was conducted to determine the feasibility of growing crop plants in sand culture to which plant nutrients were supplied, not in a nutrient solution, but as adsorbed cations and anions on synthetic resins, known as "Amberlites." Tomatoes and lettuce were used as indicator crops. They were grown in surface-irrigated large production-scale beds as well as in sub-irrigated small cultures. Chemical analyses were made of leachates from the various cultures and of leaves, stems, and fruits of plants grown under the different experimental conditions. Two principal nutrient combinations were in-

* International Conference held in London, July 17-24, as reported in September *Agricultural Chemicals.*

vestigated: (a) one in which all the nutrient ions were furnished in an adsorbed form on Amberlites and (b) another in which potassium and nitrogen were supplied by daily irrigations of a dilute KNO_3 solution but all the other nutrients were furnished as in (a). In the (a) treatment calcium and magnesium were found unavailable for plant growth. Good growth and fruiting were obtained in (b). An investigation of the chemical properties of the nutrient medium disclose that the non-availability of the adsorbed divalent ions was associated with their relatively low degree of saturation on the adsorbing surfaces. The relation of these findings to soil is discussed in the paper.

AVAILABILITY OF NITROGEN IN COMPOSTS PREPARED FROM STRAW AND TOWN REFUSE TREATED WITH SEWAGE SLUDGE. *By C. Bould,* Long Ashton Research Station, Bristol, England. In order to obtain maximum results from the use of compost it is necessary to have some knowledge of its state of maturity and the availability of its nutrients. A determination of the carbon/nitrogen ratio will give information on the former, while the latter may be determined, for nitrogen, by any one of several methods. When dealing with town refuse composts it is necessary to estimate, and correct for, the inert carbon and nitrogen present in the form of coal and its degradation products.

Field experiments have shown that, for certain crops, compost alone will not give maximum yield, or maintain an adequate nitrogen status in the plant. In most cases an additional response can be obtained by supplementing with artificial nitrogen. Composts should therefore be regarded primarily as soil improvers, in the physical sense; their nutritional effect, so far as nitrogen is concerned, being only of secondary importance.

NUTRITIONAL SURVEYS OF FARM CROPS IN ENGLISH COUNTIES (1945-1946). *By W. Plant,* Long Ashton Research Station, Bristol. Section 5. During the last few years a field technique has been developed at Long Ashton for determining the nutrient condition of growing crops. In this paper an account is given of the application of this technique for carrying out crop surveys in order to determine, among other things, the extent of N, P, K, Ca, Mn and B deficiencies on tillage land. Results are tabulated to show the relationship between deficiencies and crops, crop yields, specific farming districts and all tillage land. The major element deficiencies in order of importance were P, N, K and Ca: the only trace element deficiency noted was B. A deficiency of N was found in all crops; P deficiency predominated in cereals; K. deficiency was apparently confined to potatoes and mangolds alone.

Others Papers Presented

"Fertilizer Placement in relation to Yield and Quality of Tomatoes with Observations on the Incidence of Blossom End Rot-I." By C. A. Eaves and H. B. Cannon, Division of Horticulture, Experimental Farms Branch, Dominion Department of Agriculture, Ottawa, Canada.

"A Ratio Law Governing the Equilibrium of Cations in the Soil Solution." By R. K. Schofield.

"Studies of Magnesium Deficiency Control in Quebec Apple Orchards." By H. Hill, Division of Horticulture, Central Experimental Farm, Ottawa, and F. B. Johnston, Division of Chemistry, Science Service, Central Experimental Farm, Ottawa, Canada.

"Rapid Determination of Potassium, Calcium and Magnesium in Plant Tissues." By F. B. Johnston, J. R. W. Miles and H. Hill, Ottawa, Canada.

"The Use of Chemical Tissue Tests in the Diagnosis of the Mineral Status of Plants." By D. J. D. Nicholas, University of Bristol, Long Ashton Research Station, England.

"The Study of Mineral Nutrition of Plants by Plant Analysis, Plant Injection and Measurement of the Effect of Curative Treatment." By W. A. Roach, East Malling Research Station, England.

"'A Technique for Large Scale Pot Sand Cultures." By E. J. Hewitt, Long Ashton Research Station, Bristol, England.

Animal Feeding Materials

"Animal Nutrition: Wood Pulp (Fodder Cellulose) and Silage made with added acids," by Sam Nordfeldt, Upsala, Sweden.

"Use of Chemicals in the Preservation of Animal Feeding Stuffs in Denmark." By V. Steensberg, Copenhagen, Denmark.

"Use of Chemicals for the Preservation of Animal Feeding Stuffs in Holland." By N. D. Dijkstra, Hoorn, Holland.

"The Galactopoietic Action of Anterior Pituitary Extracts in Milking Cows." By S. J. Folley and F. H. Young.

"Trace Elements in Animal Nutrition," by J. O. Henizl, Zurich, Switz.

"Trace Elements in Animal Nutrition — British Viewpoint." By James Stewart, Gilmerton, Edinburgh.

"Autointoxication in Cattle and Horses in Relation to Food," by L. Seekles, Utrecht, Netherlands.

International Group studies soil fertility . . . trace elements discussed . . . adding chemical fertilizer to soil to increase food value of crops . . . application methods viewed . . . spraying feasible under some conditions

Comments....

By Dr. Alvin J. Cox

This column by Dr. Cox appears as a regular feature of AGRICULTURAL CHEMICALS. Dr. Cox formerly was successively Physical Chemist, Chief Chemist, Assistant Director, and Director of the Bureau of Science, Government of the Philippines. He was appointed Chief, Bureau of Chemistry, California State Dept. Agriculture in 1932, retiring in 1945.

THE fashion today in many quarters seems to be one attack after another upon the capitalistic system, ignoring the fact that under a system of free private enterprise we have built up in this country a more efficient productive machine, and given to the workers who operate our economic system a greater return than in any other state in the world. Under our competitive system, the profit motive acts as a continual stimulus to manufacturers to develop new, more effective and more saleable products. For instance, the incentive to develop new agricultural chemicals has been of benefit all along the line, providing jobs for the workers in these companies, offering profits for the manufacturer, and most important of all, providing increased yields of higher quality crops for the buyers and users of these materials.

While adhering tenaciously to our basic system of free private enterprise in the face of these continual attacks upon it, we must still modify some of the basic motives of enlightened selfishness which make the system work. Continued aggressive competition among the units of the industry is a very healthy situation, yet seldom can a company be completely successful in marketing a product exclusively for profit. Our system works best, and companies seem to prosper best, when they have other motives deeper than that of profit, and feel a continuing compulsion to supply products which will serve the user effectively and economically.

In addition to supplying the best possible product, the enlightened manufacturer of agricultural chemicals knows that it is good business for him to tell the user more about his product, — when it should be used, how it should be used, precautions to be observed in its use. To supply such information is not only essential self-protection, but serves to build good-will and help build future sales. Farmers and growers have learned to depend upon county agents and experiment station personnel for unbiased advice on what to use for various pest control problems, but often the manufacturer is in a better position than anyone to advise about his own product. His advice can be extremely helpful to the user if it can be counted upon to be accurate. In the long run the manufacturer will certainly find that over-enthusiasm and superlative claims, while they may produce sales on a short term basis, are certainly no dependable platform on which to erect a structure of permanent acceptance.

Particularly in the agricultural chemical field is it difficult to predict with assurance from year to year what materials growers will demand and use. Aside from the personal preferences of buyers, and the acceptance which salesmen can build up for a product, consumption is influenced in an important way by the cyclic appearance and the varying severity of pest infestations, or by changes in the types of crops planted from year to year. For these and other reasons, materials on hand in warehouses which remain unsold for an entire season are often found to be unusable the next season. The problem of deterioration is an important factor in determining the saleability of such carry-over stocks. For example, ammonium nitrate will harden in the bags, while calcium arsenate will carbonate and release water-soluble arsenic. It takes a certain amount of courage and a very definite insistence on honest dealing for the owner of such unusable stocks not to try to sell them as is to unsuspecting buyers. But in the long run this course is the only one on which a dependable business future can be built.

The spectacular progress of agricultural chemical developments should be matched by an equally energetic educational campaign on the part of manufacturing firms to inform the consumer of proper methods of use and hazards to be avoided in use. Standardization of all products will help to remove unexpected hazards. The importance of thorough-going laboratory control in all stages of manufacture cannot be over-emphasized. In working with new materials, there is special danger for the manufacturer because frequently the full possibility of hazard has not been forseen until the product has been on the market for some time.

Persons new to the industry often have a particularly difficult time in collecting even such information as is generally known in the trade about certain products. New materials nearly all lack complete backgrounds, and for many, data are lacking with respect to toxicity to human beings. Other unanswered questions include the depositional characteristics, weather-resistant qualities, the influence of the order of mixing and other factors.

(*Turn to Page 77*)

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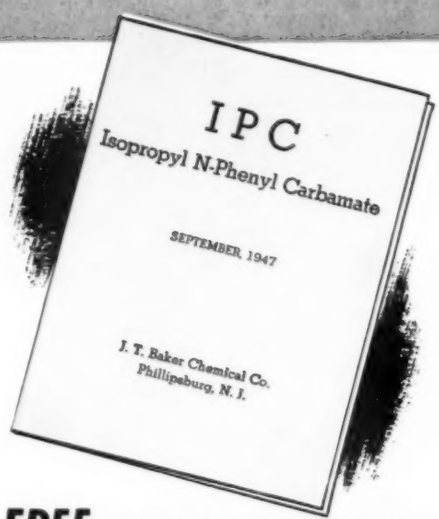

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The Listening Post

Insect Conditions In Late August & Early September

This column, reviewing current insect control programs, is a regular feature of AGRICULTURAL CHEMICALS. Mr. Haeussler is in charge of Insect Pest Survey and Information, Agric. Research Adm., B. E. & P. Q., U.S.D.A. His observations are based on latest reports from collaborators in the department's country-wide pest surveys.

By G. J. Haeussler

THE boll weevil had largely reached its peak by the middle of August. Hot, dry weather in most of the areas where the weevil occurs aided in killing millions of the insect in all stages of development. According to the reports of entomologists in several states, cotton growers have taken an unusual interest this year in controlling the boll weevil by the use of insecticides. The more general and careful use of insecticides has had an important part in holding down populations of the weevil in many areas.

By mid-August the cotton leafworm had been found this year in seven counties of Texas; namely, Calhoun, Nueces, Refugio, Burleson, Jackson, San Patricio, and Victoria. A light infestation, generally distributed over the five fields in which it was observed, was also reported by that time in Walton County, Florida, near the Alabama-Florida state line.

The bollworm was reported causing serious damage in cotton fields of Arizona, New Mexico, Oklahoma, Texas, Louisiana, and Mississippi around the middle of August.

Infestations of the Mexican bean beetle continued moderate to heavy during the last half of August and first half of September in most southern districts and in New Jersey and Tennessee. An apparently isolated infestation on garden beans reported in September by State authorities at Blaine in Aroostook County, Maine, is believed to be the most northerly known point of Mexican bean beetle infestation in that state. Adults, eggs, and young larvae collected on August 20 in a small garden near Madison, Wisconsin, constitute the first known record of that insect from Wisconsin.

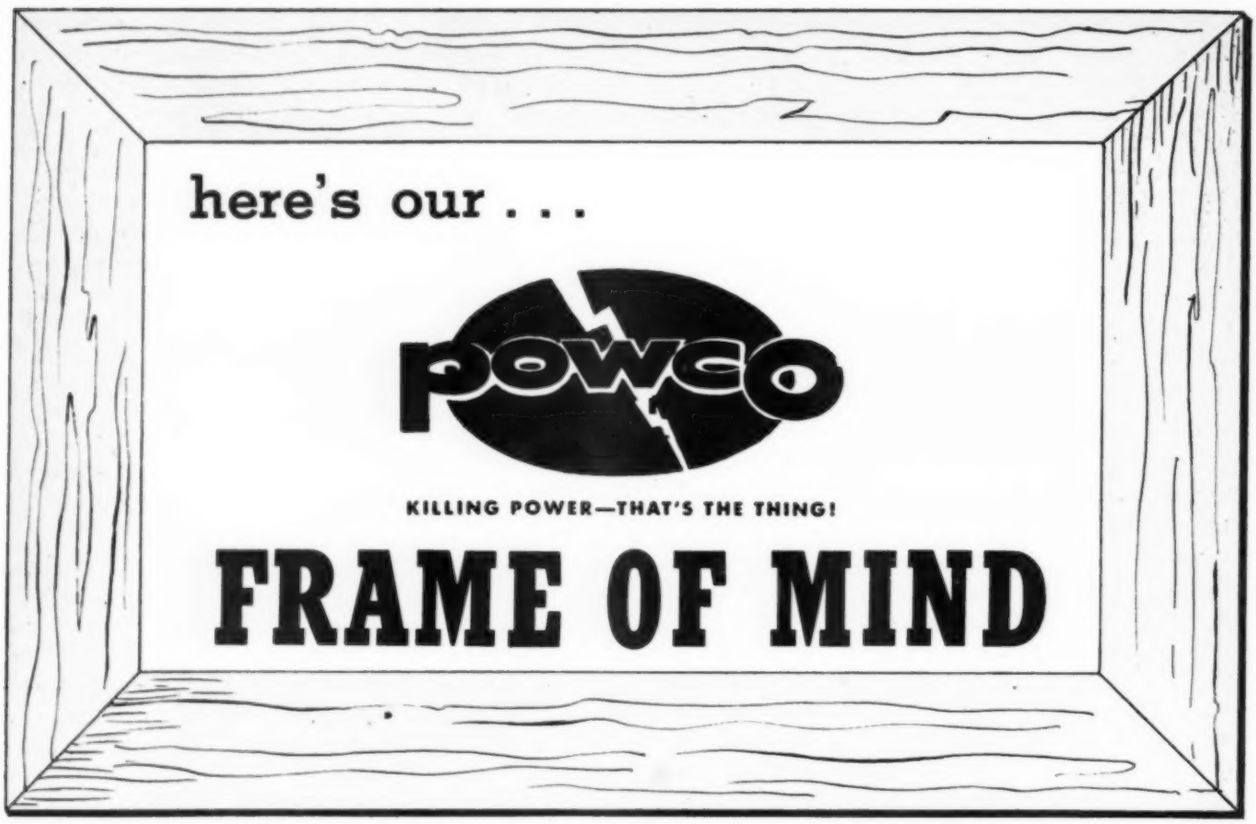
The potato leafhopper has remained generally at a low level of infestation on beans except in Wisconsin, where it has been reported throughout the last half of August and first half of September as causing severe damage in some fields. It appeared to increase in numbers somewhat in Virginia during the first two weeks of September. Toward the middle of that month, the garden fleahopper was numerous on beans in Maryland, and moderate to heavy populations of the bean leaf roller were reported on beans in Virginia, eastern North Carolina, and South Carolina. At that time, the corn earworm was also occurring in destructive numbers on beans in parts of Virginia and North Carolina.

Cabbage caterpillars were abundant the last half of August on cabbage and related crops in Virginia, Maryland, Wisconsin, and Minnesota; they remained abundant in Wisconsin at least until mid-September; and populations were heavy in eastern North Carolina toward the middle of that month. They were present, though in lesser numbers, throughout the period in a number of other states from which reports were received.

Severe infestations of the harlequin bug were reported on cole crops in Virginia and Tennessee shortly after the middle of August. These persisted right through to the middle of September, and by that time similar infestations were reported from North Carolina, Georgia, Florida, and Alabama. At that time the green stinkbug was also numerous on crucifers in Georgia, Florida, and Alabama.

Infestations of aphids on cole crops appeared to be decreasing in many areas during late August and early September. By the middle of the latter month light to moderate numbers were still being reported as present on these crops in New Jersey and Virginia. Populations of the buckthorn, potato, green peach, and foxglove aphids continued to decline on potatoes in Maine during the first half of September.

The green peach aphid, which occurred earlier in the season in a serious outbreak on tobacco, declined rapidly in the Florida-Georgia and northwestern Tennessee areas shortly after the middle of August. Populations of that aphid on tobacco were also declining at that time in Maryland, due apparently to the activities of ladybeetles and other predators. By the end of August, aphids on tobacco were decreasing on the open or sun-grown types in Connecticut, but increasing on the shade-grown tobacco. A light but general infestation of aphids on tobacco was reported early in September from Dane and Rock Counties, Wisconsin. The infestations in that state occurred too late in the season to cause much damage, since tobacco was being harvested at that time. Reports from the burley tobacco-producing counties of Ohio toward the middle of September indicated that aphid infestations did not occur on tobacco in that area. A report from Ontario, Canada, shortly after the middle of August indicated that although aphids were present on tobacco there during the 1946 season, they did not occur in injurious numbers. They were, however, more abundant in 1947 and severely damaged tobacco on several farms in the flue-cured belt near Port



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Stanley, Ontario, and on one or two farms in the burley belt near Cedar Springs, Ontario. The report indicated that, so far as known, 1947 is the first year during which aphids caused commercial damage to tobacco in Ontario, and although the species concerned has not been identified it is believed to be the green peach aphid.★★

Report on Melon Mosaic in So. California

This department, which reviews current plant disease and insect control problems, is a regular monthly feature of AGRICULTURAL CHEMICALS. The comments on current plant disease problems are based on observations submitted by collaborators of the Plant Disease Survey, Bureau of Plant Industry, Soils, and Agricultural Engineering, U. S. Department of Agriculture, Beltsville, Md.

By Paul R. Miller

THE first article on the subject of melon mosaic appeared in this column in November, 1946. Since that report was made, it has been estimated that a crop loss of about 2½ million dollars was incurred in the 1946 melon harvest. The 1947 melon plantings were found to be generally infected with the virus; infection varied in cantaloups from 53% to 100%, whereas honeydews varied from 84% to 100%. A survey was made of the melon-growing areas of Yuma, Arizona, and Palo Verde Valley adjacent to the Colorado River, near the town of Blythe, California. The virus infection in Yuma was very similar to that observed in the Imperial Valley of California, although there may have been somewhat less fruit loss due apparently to a later date of infection. In the Palo Verde Valley heavy losses were incurred on some cantaloups but primarily on honeydews. Plantations adjacent to irrigation and drainage systems which were overgrown with vegetation were more severely infected than fields adjacent to waterways relatively free from natural plant growth.

In the early spring, usually the latter part of March and early April, winged forms of the aphids are prevalent in large numbers. It has been established that some of these aphids are viruliferous upon entry into melon plantings. Inasmuch as the virus may be seed-borne, nonvirulferous aphids entering the field may readily acquire the virus through feeding on infected plants, resulting from a planting of infected seed; subsequent spread of the disease results from vector movement. A number of common weeds have been found to harbor the cantaloup mosaic virus.

Control of the disease presumably rests upon the planting of virus-free seed, elimination of vectors, and host reservoirs of the virus. With the present shortage of efficient aphicides, it is of interest to note that plantings of sulfur-resistant cantaloups that have been sulfured regularly once the runners have formed, have remained comparatively free from mosaic, whereas sulfur-resistant cantaloups that have not been sulfur dusted were severely infected. Likewise, honey dews that have been sulfured regulary, but primarily for the control of powdery mildew, contain less mosaic than honeydews which have not been sulfured. It is assumed that the freedom from mosaic is due to the action of sulfur upon the migrating aphid vectors.

As a consequence of these field observations, it is felt that some relief may be secured from the effects of the virus if sulfur-resistant melon varieties are grown and given frequent sulfur applications for the control of aphids, which introduce and spread this virus disease.

Onion Mildew in Louisiana

IT is reported that onion mildew (*Peronospora destructor* occurred in widespread and destructive form in southern Louisiana during the spring of 1947. The disease caused more severe damage over a wider area than in any previous season for many years. Mildew often causes serious losses on onions grown for bulbs in the lower Bayou LaFourche area, and occasionally in other sections of the state. But this season the damage was widespread over practically the entire onion growing area.

Losses were not as heavy this year in bulb onions as in those grown for seed. Most of the important seed growers suffered heavy losses. There were comparatively few seed of the Creole variety saved. Since this variety makes up the bulk of the onions grown in the state, the loss from mildew was rather serious. One planting of stock seed of a selected strain of Creole was completely wiped out on the Experiment Station grounds at Baton Rouge.

Shallots were affected with mildew again this year, but infection was not nearly so widespread or destructive as in the spring of 1946. Some shallot progenies in the breeding plots at Baton Rouge were severely affected. All the seed stalks in one plot were killed, and the tops of most of the plants were badly burned. Many of the seeding progenies were lost because they were killed back before sets were formed.★★

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New Geigy Fungicide

Geigy Co., Inc., New York, has announced a new product, "GY-COP 53," a chemically stable, insoluble basic copper sulfate. The manufacturers guarantee a 53 percent metallic copper content in the product which is used for control of plant diseases such as early and late blight on potatoes, blotch and bitter rot on apples, black rot on grapes, scab and melanose on citrus. Literature with further description of the product is available from Geigy Co., Inc., 89 Barclay St., New York 8.

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Offers 2,4-D Information

Michigan Chemical Corporation, St. Louis, Mich., offers literature giving detailed information on 2,4-D; when, where, and how to apply it.

PENCO

BHC PRODUCTS

(Benzene Hexachloride)

HIGH QUALITY TECHNICAL
36% GAMMA CONTENT

To the basic agricultural insecticide manufacturer, Pennsalt now offers technical Benzene Hexachloride.

An improved method is used in the manufacture of Penco Benzene Hexachloride, resulting in a product of high quality and an unusually high gamma content of 36%. The manufacturer and distributor will readily translate these features in terms of *more* warehouse space and *lower* handling costs. Also, this high strength product permits manufacture of dusts and spray bases with preferred qualities for agricultural applications.

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In addition to technical grade, Penco Benzene Hexachloride is also available in the following concentrates:

PENCO W-12—A wettable powder containing 12% gamma isomer. An effective micron-sized product especially compounded for spray application.

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PENCO SOLVENT CONCENTRATE—An oil concentrate containing 9% gamma isomer, or .802 lb. actual gamma isomer per gallon. Especially suited for manufacture of oil sprays or specialty products.

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AGRICULTURAL CHEMICALS DIVISION

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TACOMA, WASH. BRYAN, TEXAS

Insecticide Act Regulations

U. S. D. A. Issues Regulations for enforcement of New Insecticide Act...sections dealing with shipments of experimental material and use of warning and caution statements liberalized

REGULATIONS for the enforcement of the new Federal Insecticide, Fungicide and Rodenticide Act of 1947 were issued by the U. S. Department of Agriculture September 29, and applications for the registration of economic poisons under the Act are reported to have been forwarded to manufacturers of products subject to the Act.

The registration deadline for rodenticides and herbicides is set for December 25, 1947. Manufacturers of other products (including insecticides and fungicides) must register them with the Department by June 25, 1948. Manufacturers were urged by the U.S.D.A. to submit applications promptly in order to avoid the usual log-jam at deadline time.

The final and official draft of the regulations follows in general the proposed regulations issued on June 25. The final draft was not announced until comments and suggestions made at the public hearing in Washington on August 25 had been given full consideration. An extension of time permitted the filing of additional suggestions through September 8.

The most significant changes from the first draft of the regulations include permission for label statement to be in language other than English when product is for shipment outside the U. S. (Section 162.3). More specific language regarding products highly toxic to man is also called for in the final regulations. LD-50 tests are incorporated, and toxicity tests must be run on mice, rabbits and rats. (Section 162.7).

Simplification of the warning or caution statement is attained by leaving to registrant the decision whether a warning or caution statement is required. Definition of terms "Danger," "Warning" and "Caution" is eliminated. (Sec. 162.8). Liberalization of provisions for shipments of experimental material is made, and the requirement is removed which called for giving composition of experimental material in application for exemption permit. (Sec. 162.17).

The section relating to economic poisons intended for export was deleted, (Sec. 162.18 a), since this phase is covered by paragraph "b" of Section 3 of the Act. The remaining part of section 162.18 is amended by adding commercial laundries and cleaners to the list of exempted industries.

The full text of the regulations follows:

TITLE 7—AGRICULTURE
CHAPTER I—PRODUCTION AND MARKETING ADMINISTRATION (STANDARDS, INSPECTIONS, MARKETING PRACTICES)
PART 162—REGULATIONS FOR THE ENFORCEMENT OF THE FEDERAL INSECTICIDE, FUNGICIDE, AND RODENTICIDE ACT
REGULATIONS

By virtue of the authority vested in the Secretary of Agriculture by the Federal Insecticide, Fungicide, and Rodenticide Act, approved June 25, 1947 (Pub. Law 104, 80th Cong.) and the Administrative Procedure Act (60 Stat. 237), the following regulations are hereby promulgated:

Sec.

162.1 Words in singular form.
162.2 Terms defined and construed.
162.3 Administration.
162.4 Language to be used.
162.5 Omission of label or labeling.
162.6 Label.
162.7 Ingredient statement.
162.8 Economic poisons highly toxic to man.
162.9 Warning or caution statement.
162.10 Registration.
162.11 Guarantee of economic poisons.
162.12 Coloration and discoloration.
162.13 Adulteration — valuable constituent.
162.14 Misbranding.
162.15 Enforcement.
162.16 Notice of judgment.
162.17 Shipments for experimental use.
162.18 Exemption.

(Pub. Law 104, 80th Cong., 60 Stat. 237)

§162.1 *Words in singular forms.* Words used in the singular form in these regulations shall include the plural, and vice versa, as the case may require.

§162.2 *Terms defined and construed.* All terms used in these regulations shall have the meaning set forth for such terms in the Act. In addition, such terms shall be construed as follows:

(a) *Act.* "Act" means the Federal Insecticide, Fungicide, and Rodenticide Act.

(b) *Director.* "Director" means the Director of the Livestock Branch, Production and Marketing Administration, United States Department of Agriculture, or any officer or employee to whom he has heretofore lawfully delegated or to whom he may hereafter lawfully delegate the authority to act in his stead.

(c) *Economic poison.* "Economic poison" includes insecticides, fungicides, rodenticides and herbicides. A product shall be deemed to be an economic poison regardless of whether intended for use as packed or after dilution or mixture with other substances, such as carriers or baits. Products intended only for use after further processing or manufacturing, such as grinding to dust form or more extensive operations, shall not be deemed to be economic poisons. Substances which have recognized commercial uses other than uses as economic poisons shall not be deemed to be economic poisons unless such substances are (1) specially prepared for use as economic poisons, or (2) labeled, represented, or intended for use as economic poisons, or (3) marketed in channels of trade where they will presumably be purchased as economic poisons.

(d) *Fungicide.* "Fungicide" includes but is not limited to:

(1) Plant fungicides, seed fungicides, fungicidal wood preservatives, and mildew and mold preventatives,

(2) Disinfectants, antiseptics and sterilizers, except those for use only on or in living man or other animals.

The term "fungicide" shall not include algaecides.

(e) *Active ingredient.* An "active ingredient" is an ingredient which:

(1) is capable in itself, and when used in the same manner and for the same purposes as directed for use of the product, of preventing, destroying, repelling, or mitigating insects, fungi, rodents, weeds or other pests; and

(2) is present in the product in an amount sufficient to add materially to its effectiveness; and

(3) is not antagonistic to the activity of the principal active ingredient;

Provided, however, that the Director may require an ingredient to be designated as an active ingredient if, in his opinion, it sufficiently increases the effectiveness of the economic poison to warrant such action.

(f) *Rodent.* "Rodent" means any animal of the order Rodentia, including, but not limited to, rats, mice, rabbits, gophers, prairie dogs and squirrels.

(g) *Official investigator.* "Official investigator" means any employee or agent of the Department of Agriculture or the Treasury Department authorized by the Director or by the Secretary of the Treasury to make investigations in connection with enforcement of the Act.

§162.3 *Administration.* The Director is authorized to take such action as, in his discretion, may be necessary in the administration and enforcement of the Act and these regulations.

§162.4 *Language to be used.* All statements, words and other information required by the Act or regulations to appear on the label or labeling of any economic poison shall be in the English language, provided that in the case of articles intended solely for distribution to points outside the continental United States the appropriate foreign language may be used in lieu of the English language.

§162.5 *Omission of label or labeling.* The omission of a label or labeling from any economic poison shall not affect any provision under the Act or these regulations with respect to any statement required to appear on such label or labeling.

§162.6 *Label.*

(a) *Contents of label.* The label of every economic poison must show, clearly and prominently, the name of the product; the name and address of the manufacturer, the registrant, or person for whom manufactured; the net contents; the ingredient statement; and a warning or caution statement which may be necessary to prevent injury to living man and other vertebrate animals, useful vegetation and useful invertebrate animals. The label of any economic poison which is highly toxic to man must also contain the skull and crossbones, and the word "poison" in red on a contrasting background and the antidote statement in immediate proximity thereto. The antidote statement shall include directions to call a physician immediately. The label of every economic poison, if necessary to prevent injury to living man and other vertebrate animals, useful vegetation and useful invertebrate animals, must contain an appropriate warning or caution statement as required in Section 162.9 hereof.

(b) *Name and address of manufacturer.* An unqualified name and address given on the label shall be considered as the name and address of the manufacturer. If the registrant's name appears on the label and the registrant is not the manufacturer, or if the name of the person for whom the economic poison was manufactured appears on the label, it must be qualified by appropriate wording such as "Packed for * * *," "Distributed by * * *," or "Sold by * * *," to show that the name is not that of the manufacturer. When a person manufactures an economic poison in two or more places or in a place different from the manufacturer's principal office, the actual place of manufacture of each particular package need not be stated on the label except when, under the special circumstances existing, the failure to name it may be misleading to the public. The address of the manufacturer, registrant or person for whom manufactured shall include the street address, if any, unless the street address is shown in a current city directory or telephone directory.

(c) *Name, brand or trademark of economic poison.* The name, brand or trademark of the economic poison appearing on the label shall be that under which the economic poison is registered.

(d) *Net content.*

(1) The net content shall be exclusive of wrappers or other material, and shall be deemed to be average content unless stated as a minimum quantity.

(2) Net content shall be stated in the terms of weight or measure in general use by consumers and users of the economic poison to give accurate information as to the quantity of the economic poison. If there is no general use, the net content statement shall be in terms of liquid measure if the product is a liquid, and in terms of weight if it is a solid, semi-solid, viscous, or a mixture of liquid and solid. Statements of liquid measure shall be in terms of the United States gallon, quart, pint, and fluid ounce, at 68° F. The statements of weight shall be in terms of avoirdupois pound and ounce. All statements of net content shall be in terms of the largest unit present.

(3) If the contents are stated as a minimum quantity, variation below is not permissible and variation above shall not be unreasonably large.

(4) If the contents are not stated as a minimum quantity, variation shall be permitted only to the extent that it represents deviations unavoidable in good packing practice. The average quantity in the packages in a shipment shall not fall below the average quantity stated, nor shall there be any unreasonable variation from the average in the contents of any package.

§162.7 *Ingredient statement.*

(a) *Location of ingredient statement.* The ingredient statement must appear on that part of the label displayed under customary conditions of purchase except in cases where the Director determines that, due to the size or form of the container a statement on that portion of the label is impractical, and permits such statement to appear on another side or panel of the label. When so permitted, the ingredient statement must be in larger type and more prominent than would otherwise be possible. The ingredient statement must run parallel with other printed matter on the panel of the label on which it appears and must be on a clear contrasting background not obscured or crowded.

(b) *Names of ingredients.* The well-known common name of the ingredient must be given or, if the ingredient has no common name, the correct chemical name. If there is no common name and the chemical composition is unknown or complex, the Director may permit the use of a new or coined name which he finds to be appropriate for the information and protection of the user. If the use of a new or coined name is permitted, the Director may prescribe the terms under which it may be used. A trademark or trade name may not be used as the name of an ingredient except when it has become a common name.

(c) *Percentages of ingredients.* Percentages of ingredients shall be determined by weight and the sum of the percentages of the ingredients shall be 100. Sliding scale forms of ingredient statements shall not be used.

(d) *Designation of ingredients.*

(1) Active ingredients and inert ingredients shall be so designated, and the term "inert ingredients" shall appear in the same size type and be equally as prominent as the term "active ingredients."

(2) If the name but not the percentage of each active ingredient is given, the names of the active and inert ingredients shall, respectively, be shown in the descending order of the percentage of each present in each classification and the name of each ingredient shall be given equal prominence.

(e) *Active ingreident content.* As long as an economic poison is subject to the Act the percentages of active ingredients declared in the ingredient statement shall be the percentages of such ingredients in the economic poison.

§162.8 *Economic poisons highly toxic to man.* The Secretary hereby finds that economic poisons which fall within any of the following categories when tested on the laboratory animals, mice, rats and rabbits, are highly toxic to man or contain substances or quantities of substances highly toxic to man within the meaning of the Act:

(a) *Oral toxicity.* Those which produce death in half or more than half the animals of any species at a dosage of 50 milligrams at a single dose, or less, per kilogram of body weight when administered orally to ten or more such animals of each species.

(b) *Toxicity on inhalation.* Those which produce death in half or more than half of the animals of any species at a dosage of 200 parts or less by volume of the gas or vapor per million parts by volume of air when administered by continuous inhalation for one hour or less to ten or more animals of each species, provided such concentration is likely to be encountered by man when the economic poison is used in any reasonably foreseeable manner.

(c) *Toxicity by skin absorption.* Those which produce death in half or more than half of the animals (rabbits only) tested at a dosage of 200 milligrams or less per kilogram of body weight when administered by continuous contact with the bare skin for 24 hours or less to ten or more animals.

Provided, however, that the Director may, upon application and after opportunity for hearing, exempt any economic poison which meets the above standard

but which is not in fact highly toxic to man, from the requirements of the Act and these regulations with respect to economic poisons highly toxic to man.

§162.9 *Warning or caution statement.* The warning or caution statement, when necessary to prevent injury to living man and other vertebrate animals, useful vegetation and useful invertebrate animals, must appear on the label in a place sufficiently prominent to warn the user, and must state clearly and in nontechnical language the particular hazard involved in the use of the economic poison, e.g., ingestion, skin absorption, inhalation, inflammability or explosion, and the precautions to be taken to avoid accident, injury, or damage.

The word "POISON" in red on a contrasting background in immediate proximity to the skull and crossbones and an antidote, including directions to call a physician immediately, shall appear on all economic poisons highly toxic to man.

§162.10 *Registration.*

(a) *Eligibility.* Any manufacturer, packer, seller, distributor or shipper of an economic poison is eligible as a registrant and may register such economic poison.

(b) *Effect of registration.* If an economic poison is registered under the Act no further registration under the Act is required, provided that:

(1) The product is in the manufacturer's or registrant's original unbroken immediate container; and

(2) The claims made for it and the directions for its use do not differ in substance from the representations made in connection with registration.

(c) *Procedure for registration.* Applications for registration should be addressed to Insecticide Division, Livestock Branch, Production and Marketing Administration, United States Department of Agriculture, Washington 25, D. C. Application forms will be furnished upon request. Applications should be submitted as far in advance as possible and at least 30 days before the time when it is desired that registration take effect. No fees are charged for registration.

(d) *Effective date of registration.* Registration of an economic poison shall become effective on the date the notice of registration is issued.

(e) *Responsibility of a registrant.* The registrant is responsible for the accuracy and completeness of all information submitted in connection with his application for registration of an economic poison.

(f) *Changes in labeling or formulae.*

(1) Changes in substance in the labeling or changes in the formula of a registered economic poison must be submitted in advance to the Insecticide Division, Livestock Branch, Production and Marketing Administration, United States Department of Agriculture, Washington 25, D. C. The registrant must describe the exact changes desired and the proposed effective date and, upon request, shall submit a description of tests which justify such changes.

(2) After the effective date of a change in labeling or formula the product shall be marketed only under the new claims or formula, except that a reasonable time may be permitted by the Director to dispose of properly labeled stocks of old products.

(g) *Claims must conform to registration.* Claims made for an economic poison must not differ in substance from representations made in connection with registration, including representations with respect to effectiveness, ingredients, directions for use, or pests against which the product is recommended.

§162.11 *Guarantee of economic poisons.*

(a) *By whom given.* Any manufacturer, distributor, wholesaler, or other person residing in the United States may furnish to any person to whom he sells an economic poison a guarantee that the economic poison was lawfully registered at the time of sale and delivery to such person, and that the economic poison complies with all the requirements of the Act and of these regulations.

(b) *Reference to guarantee.* No reference to or suggestion that a guarantee of registration has been given shall be made in the labeling of any economic poison.

(c) *Contents of guarantee.* In order to afford effective protection, each guarantee must:

(1) Be signed by and contain the name and address of the person giving it; and

(2) State that the economic poison was lawfully registered at the time of sale and delivery and that it complies with all other requirements of the Federal Insecticide, Fungicide, and Rodenticide Act.

(d) *Scope of guarantee.* A guarantee may be (1) limited to a specific shipment or other delivery of a product, in which case it may be a part of or attached to the invoice or bill of sale covering such shipment or delivery, or (2) general and continuing, in which case, in its application to any shipment or other delivery of a product, it shall be considered to have been given at the date when such product was shipped or delivered by the person giving the guarantee.

(e) *Expiration of guarantee.* Any guarantee shall expire when the product is repacked or relabeled by the purchaser or when it becomes otherwise in violation of the Act or these regulations *after shipment or other delivery* by the person who gave such guarantee.

(f) *Forms of guarantee.* The following are suggested forms of guarantee:

(1) [Limited form for use on invoice or bill of sale].

..... hereby guarantees
(name of guarantor)
that the economic poison herein listed is lawfully registered with the Secretary of Agriculture and that the same complies with all requirements of the Federal Insecticide, Fungicide, and Rodenticide Act.

.....
Signature and postoffice address of guarantor

.....
Date

(2) [General and continuing form].

The economic poisons comprising each shipment or other delivery hereafter made by .....,
(name of guarantor)
to or on the order of.....
(name and
.....
address of person receiving)
.....are hereby guar-
(guarantee)
anteed to be lawfully registered with the Secretary of Agriculture and to comply with all requirements of the Federal Insecticide, Fungicide, and Rodenticide Act, as of the date of such shipment or delivery.

.....
Signature and postoffice address of guarantor

.....
Date

§162.12 *Coloration and Discoloration.* The white economic poisons hereinafter named shall be colored or discolored in accordance with this regulation. The hues, values, and chromas specified are those contained in the Munsell Book of Color, Munsell Color Company, 10 East Franklin Street, Baltimore, Maryland.

(a) *Coloring agent.* The coloring agent must produce a uniformly colored product not subject to change in color beyond the minimum requirements specified in these regulations during ordinary conditions of marketing or storage, and must not cause the product to be ineffective or result in its causing damage when used as directed.

(b) *Arsenicals and barium fluosilicate.* Standard lead arsenate, basic lead arsenate, calcium arsenate, magnesium arsenate, zinc arsenate, zinc arsenite, and barium fluosilicate shall be colored any hue, except the yellow-reds and yellows, having a value of not more than 8 and a chroma of not less than 4, or shall be discolored to a neutral lightness value not over 7.

(c) *Sodium fluoride and sodium fluosilicate.* Sodium fluoride and sodium fluosilicate shall be colored blue or green having a value of not more than 8 and a chroma of not less than 4, or shall be discolored to a neutral lightness value not over 7.

(d) *Exception.* Notwithstanding the provisions of subsections (b) and (c) of this Section the Director, *after* opportunity for hearing, may permit other hues to be used for any particular purpose if the prescribed hues are not feasible for such purpose and if such action will not be injurious to the public.

§162.13 *Adulteration -- Valuable constituent.*

(a) A valuable constituent will be considered as wholly abstracted whenever the designation or representation of the product imports its presence therein and such constituent has been wholly omitted therefrom in the preparation of the product or has been wholly removed from the completed product.

(b) A valuable constituent will be considered as partly abstracted whenever the designation or representation of the product imports its presence therein, and such constituent is not present in the usual or customary amount or in the amount indicated in the labeling.

§162.14 *Misbranding.*

(a) *False or misleading statements.* Among representations in the labeling of an economic poison which render it misbranded are the following:

(1) A false or misleading statement concerning composition of the product.

(2) A false or misleading statement concerning the effectiveness of the product as an economic poison or device.

(3) A false or misleading statement about the value of the product for purpose other than as an economic poison or device.

(4) A false or misleading comparison with other economic poisons or devices.

(5) A false or misleading representation as to the safety of the economic

poison or of its ingredients including a statement such as "non-poisonous," "non-injurious," or "non-hazardous" unless the product is in fact safe under all conditions.

(6) Any statement directly or indirectly implying that the economic poison or device is recommended or endorsed by any agency of the Federal Government.

(7) The name of an economic poison which contains two or more ingredients if it suggests the name of one or more but not all such ingredients, even though the names of the other ingredients are stated elsewhere in the labeling, provided, however, that it is permissible, when the percentage of each active ingredient is given in the name, to omit reference in the name to the inert ingredients.

(8) Prominent reference in the labeling to one or more active ingredients without giving their percentages in immediate proximity thereto or without giving equal prominence to the other active ingredients or to the presence of inert ingredients.

(9) A true statement used in such a way as to give a false or misleading impression to the purchaser.

(b) *Justification of false and misleading statements are not permitted.*

(1) The use of any false or misleading statement on any part of the labeling, given as the statement or opinion of any person or based upon such statement or opinion shall not be justified, nor may such statement be justified by the fact that the statement or opinion is actually that of such person.

(2) The use of a false or misleading statement in the labeling cannot be justified by an explanatory statement.

§162.15 *Enforcement.*

(a) *Collection of samples.* Samples of economic poisons and devices shall be collected by official investigators or by any employee of the Federal Government, or of a State, territory, or political subdivision who has been duly designated by the Director.

(b) *Examination of samples.* Methods of examination of samples shall be those adopted and published by the Association of Official Agricultural Chemists, where applicable, and such other methods as may be necessary to determine whether the product complies with the law.

(c) *Notice of apparent violation.*

(1) If from an examination or analysis an economic poison or device appears to be in violation of the Act, a notice in writing shall be sent to the person against whom criminal proceedings are contemplated, giving him an opportunity to offer such written explanation as he may desire. The notice shall state the manner in which the sample fails to meet the requirements of the Act and the regulations.

(2) Any such person may, in addition to his reply to such notice, file within 20 days of its receipt a written request for an opportunity to present his views orally in connection therewith.

(3) No notice or hearing shall be required prior to the seizure of any economic poison or device.

§162.16 *Notice of judgment.* Publication of judgments of the courts in cases arising under the criminal or seizure provisions of the Act shall be made in the form of notices, circulars, or bulletins as the Director may direct.

§162.17 *Shipments for experimental use.*

(a) *Articles for which no permit is required.*

(1) A substance or mixture of substances being put through tests in which the purpose is only to determine its value for economic poison purposes or to determine its toxicity or other properties, and where the user does not expect to receive any benefit in pest control from its use is not considered an economic poison within the meaning of Section 2a of the Act and Section 162.2 (c) of these regulations. Therefore, no permit under this Act is required for its shipment.

(2) An economic poison shipped or delivered for experimental use by or under the supervision of any Federal or State agency authorized by law to conduct research in the field of economic poisons shall not be subject to the provisions of the Act and these regulations.

(b) *Articles for which permit is required.*

(1) An economic poison shipped or delivered for experimental use by other qualified persons but not under the supervision of a Federal or State agency authorized by law to conduct research in the field of economic poisons, shall be exempt from the provisions of the Act and of these regulations, provided that a permit for such shipment or delivery is obtained prior thereto. Permits will be of two types, specific and general. A specific permit will be issued to cover a particular shipment on a specified date to a named person. A general permit will be issued to cover more than one shipment over a period of time to different persons.

(2) All applications for permits covering shipments for experimental use must be signed by the shipper or person making delivery and must contain the following:

(i) Name and address of shipper and place or places from which shipment will be made.

(ii) Proposed date of shipment or proposed shipping period not to exceed one year.

(iii) Identification of material to be covered by permit which should apply to a single material or group of closely allied materials.

(iv) Approximate quantity to be shipped and types of tests such as greenhouse, orchard, or field.

(v) A signed statement whether the product is sold or is delivered without cost.

(vi) A signed statement that the economic poison is intended for experimental use only.

(vii) Proposed labeling which, in addition to other statements, must state that the product is for experimental use only.

(c) *Cancellation of permits.* Any permit for shipment for experimental use may be cancelled at any time for any violation of the terms thereof.

§162.18 *Exemption.* Any economic poison specified in Section 162.12 of these regulations which is intended solely for use by a textile manufacturer or commercial laundry, cleaner or dyer as a mothproofing agent, which would not be suitable for such use if colored and which will not come into the hands of the public except when incorporated into a fabric, shall be exempt from the requirements of Section 3(a)(4) of the Act and Section 162.12 of these regulations.

These regulations shall become effective thirty days after publication thereof in the Federal Register.

Issued this day of September 1947.

.....

(Secretary of Agriculture)

Fertilizer Outlook

FROM AN INTERVIEW WITH

Charles H. MacDowell

Retired vice-president and member of the board, Armour & Co.; for many years president of Armour Fertilizer Works, and former president of National Fertilizer Association.

A new appreciation of the value of commercial fertilizer materials by growers assures prosperity to the industry .... the future viewed in the light of 45 years in the trade.

YEARS of continued prosperity and activity lie ahead of the American fertilizer industry, according to Charles H. MacDowell of Winter Park, Florida, retired president of the Armour Fertilizer Works, and honorary member and former president of the National Fertilizer Association. Interviewed recently by a representative of *Agricultural Chemicals*, Mr. MacDowell expressed his firm belief in a continuation of record production by the industry for some time to come and an active, steady market which should assure prosperity for many years.

The basic reason behind his prediction of a prosperous future for the fertilizer manufacturer lies in the comparatively new appreciation by rank and file of farmers the world over, of the practical benefits of commercial fertilizers as a basic factor in expanded crop yields and reduced growing costs. Contributing and favorable factors include the wider use by growers in the midwest, the south and west, the broadening use of fertilizers on large acreage pasture lands, and the prospect for continued heavy exports to Europe and other parts of the world where a greatly increased production of foodstuffs is necessary as an important part in the solution of political and economic problems.

Mr. MacDowell, whose business life included 45 years with Armour & Company, and whose other activities took him abroad frequently, has a wealth of background from which to draw in picturing the future of the industry. During World War I, he was Director of the Chemicals Divison of the War Industries Board, with its 21 sections, and handled the nation's nitrate problems personally. He was also an Official Technical Economic Advisor to the American Commission to Negotiate Peace in association with Bernard M. Baruch, and spent many months in Paris where he witnessed the signing of the Treaty. Since then, he has been continuously active in numerous scientific and industrial pursuits, including the chairmanship of the American Trade and Industry Group of the International Chamber of Commerce which met in Rome in 1923.

Although officially retired from active participation in business, Mr. MacDowell follows developments in the fertilizer field with keen interest. However, he emphasized the fact that his comments are unofficial . . merely observations from the viewpoint of one who has been closely affiliated with the business for over a half-century. He said that the midwest offers one of the most important potential markets of all in the fertilizer field. This fact is recognized by a number of plants in that region. The Mississippi river, he said, is used for relatively inexpensive water transportation of phosphate rock from Florida mines, and sulfur from Texas and Louisiana directly into midwestern superphosphate plants.

THE conversation got around to the large number of new fertilizer plants being established in various parts of the nation aside from the midwest. Each of these, of course, is contributing to the over-all tonnage which of late has been setting new production records month after month. Soon arose the inevitable question of whether or not production will in time overrun the market. "Well," replied Mr. MacDowell, "There have always been shakedowns . . . and there always will be," but he does not expect to see a slowing down in the industry's pace for some years. He contrasted the present time with the hectic days in the 1920's when sulfate of ammonia suddenly dropped from $90 to $30 a ton and potash also took a tailspin costing the industry heavy inventory losses and causing a general disruption of business almost of panic proportions This type of happening is not likely to repeat, he said, because material prices

(*Turn to Page 79*)

Field Notes of a Du Pont Service Man
TIMELY REPORTS... which reflect the progress of chemical science in providing more effective tools for farm pest control.
OCTOBER, 1947
SUBJECT: Results with Hexachlorocyclohexane (benzene hexachloride) for control of livestock pests
AREA: Colorado
Stockmen in this area obtained effective control of cattle lice, with one spraying of Du Pont "Lexone" 50 hexachlorocyclohexane applied at the rate of 4 lbs. per 100 gallons of water.
Several thousand head of cattle were sprayed in the Colorado Springs area, and every report indicated that the material controlled lice with the first treatment.
Where the spraying was done during the heel fly season, the ranchers commented that the animals did not appear to be bothered by heel flies. They noticed the absence of the fly by the fact that the characteristic stampeding had stopped.
One herd was found to be infected with Sarcoptes Mange, and the rancher reported later that one spraying of "Lexone" 50 cleared up the mange completely.

In extensive field trials on livestock and crops, "Lexone" 50 has shown definite promise as an effective control for many serious agricultural pests.

This versatile new Du Pont insecticide contains 6% of the gamma isomer of hexachlorocyclohexane (benzene hexachloride) in a formulation designed for use as spray or dust.

"Lexone" 50 has also given significant control of boll weevil, aphids and thrips on cotton when applied as a dust in combination with "Deenate" DDT. Other uses for "Lexone" 50 are now being explored.

For new and better farm chemicals today . . . and in the years ahead . . . look to Du Pont.

E. I. du Pont de Nemours & Co. (Inc.), Grasselli Chemicals Dept., Wilmington 98, Delaware.

"LEXONE" and "DEENATE" are Trade Marks of E. I. du Pont de Nemours & Co. (Inc.)

DU PONT
REG. U.S. PAT. OFF.

BETTER THINGS FOR BETTER LIVING
.. THROUGH CHEMISTRY

DU PONT PEST CONTROL PRODUCTS

Suppliers' Bulletins

Cyanamid Offers Folders

American Cyanamid Co., New York, has recently issued four booklets covering the firm's products "Accotox 50% DDT Wettable Powder," "Accotox DDT Insecticides," "Barweed 2,4-D Weedkiller," and "Barsprout," a sprouting inhibitor. The insecticide folders give full description of the products, and instructions for use on livestock and on various crops. For the latter, charts are presented to tell the percentage of DDT to use for various vegetable and field crops, the number of pounds per acre, and the number of applications per season. The same is true of the folders describing the 2,4-D product and sprout inhibitor. All folders are fully illustrated, and are available from the American Cyanamid Co., 30 Rockefeller Plaza, New York 20.

•

"Pittcide" Booklet

Columbia Chemical Division of Pittsburgh Plate Glass Co., Pittsburgh 13, Pa., has offered a booklet describing its product "Pittcide" for use in sanitation on the farm. The product is recommended for milking equipment and for other dairy uses.

•

Prentiss Offers Folder

A new 8-page folder has been released by R. J. Prentiss & Co., Inc., 110 William St., New York 7, on benzene hexachloride. The booklet describes the advantages and limitations of the insecticide, and presents a summary of the field work done to date with the material. This summary is in tabular form, showing the insects controlled, the applications, and results in each case.

•

Mixing, Blending Booklet

Sprout, Waldron & Co., Muncy, Pa. have published an eight-page bulletin illustrating and describing processing equipment manufactured by the firm. Pictured in the booklet are various grinders, mixers, crushers, rotary knife cutters, supplementary equipment, and special purpose units. Full descriptions are given for each, and diagrams are provided to illustrate various installations.

•

St. Regis Offers Folder

"Case History No. 16" is the name of a new booklet recently published by St. Regis Sales Corp., sales subsidiary of St. Regis Paper Co. It describes use of its "Multiwall" paper bags, suitable for fertilizer and other materials in the chemical field, and pictures a number of scenes where the bags are being used.

•

IPC Bulletin by Baker

J. T. Baker Chemical Co., Phillipsburg, N. J. has prepared a technical bulletin on "IPC" weed killer. It describes the herbicidal activity of isopropyl N-phenyl carbamate, pointing out that the material is not effective against crabgrass as is frequently thought, but is highly active against quackgrass. The use of NPC as a growth regulator for plant species other than quackgrass is still largely experimental, the bulletin states. It goes on to discuss the application of the material, its persistence, and properties and toxicity. Copies are available.

•

Pestmaster Folders Out

Michigan Chemical Corp., St. Louis, Mich., has issued folders containing detailed information on correct application of DDT on livestock and on various farm and garden crops. Literature describes the company's "Pestmaster" colloidal dispersion DDT, a creamy liquid which mixes well with water and leaves an almost invisible residue on leaf surfaces. Recommendations contained in the folders are for specific applications prepared after long experiments by Michigan Chemical Corp. entomologists, government agencies, and a number of universities. Subjects covered by the literature include control of pests on peas, onions, grapes, potatoes, apples, corn, cabbage, and for use on livestock and in general on the farm.

•

Larvacide Display

Innis, Speiden & Co., New York, have put on the market a new display for their larvacide dispenser package. The one-pound dispenser bottles, each in a sealed can, are said to afford easy application of the toxic material.

•

Rotenone Booklet Offered

Orbis Products Corp., 215 Pearl St., New York, offers a booklet describing "Orbiscide Rotenone Resins" for the manufacture of agricultural sprays and specialty rotenone products. The booklet, fully illustrated, gives manufacturers of finished agricultural insecticides a description of rotenone resin and its application. It also sums up the advantages of rotenone resin, describing its activity, convenience and safety to warm-blooded animals. Formulas are also given for preparation of oil concentrates and garden sprays.

•

"Pennclean" Booklet Out

Pennsylvania Salt Manufacturing Co., Philadelphia, has issued a six-page leaflet describing its new milkstone remover, "Pennclean." The bulletin describes the product and explains its use in removing from dairy utensils such films as milkstone, casein and dried-on milk deposits. Copies are available from the B-K Division of the company, 1000 Widener Bldg., Philadelphia 7.

•

Fertilizer Need in Canada

Demand for fertilizer materials in Canada, like that of the United States, has outstripped production. Reports coming from the Dominion indicate that although production was at least twice that of five years ago, Canadian fertilizer plants fell 20 percent short of meeting the need during the late fertilizer year. For the past four years the supply has been short of the demand.

Even a big-league pitcher can't be sure of hitting a bug with a baseball—*which is another way of saying that micro-fine particle size is a vital factor in the effectiveness of insecticide dusts . . .*

ATTENTION, DUST MIXERS:

ORTHO now offers you micro-fine dust concentrates for your manufacture of high-quality insecticide dusts

ORTHO'S micro-fine concentrates are manufactured with special attention to fineness of particle size and uniformity, using special diluents to give proper adhesiveness to plant surfaces and dispersibility in the finished dust. They are made up for convenient usage in your plant.

Before ordering dusts it will pay you to investigate the many decided advantages of using ORTHO micro-concentrates in your dust formulation.

We can supply you now with

GAMTOX Micro-Concentrate No. 100
(contains 10% Gamma Isomer of Benzene Hexachloride)

PERSISTO Micro-Concentrate
(contains 50% DDT)

Plus other micro-concentrates

Write or wire for prices, packings and samples from the following ORTHO offices: California Spray-Chemical Corp., Elizabeth, New Jersey; Orlando, Florida; Dallas, Texas; Kansas City, Missouri; Portland, Oregon; and Whittier and Richmond, California.

FREE "ORTHO" SERVICE! Through your ORTHO Fieldman you can get full information on formulation, fillers, uses, technical improvements on mixing, milling and testing procedures. Also facts on test runs for special problems and formulations.

ORTHO
SCIENTIFIC PEST CONTROL

Technical Briefs

Grain Fumigation

The minimum lethal concentration of ethylene dibromide in free space for adult *Sitophilus* (*Calandra*) *oryza* was 5-8 mg. per liter for a 4-hour exposure, and 1-2 mg. per liter for a 24-hour exposure. It was 13-17 mg. per liter and 2 mg. per liter correspondingly for adult *Tribolium* sp. This compound was about as toxic as methyl bromide in free space to these insects, and much more toxic than ethylene dichloride and carbon disulfide. Ethylene dibromide does not affect the germinaton of wheat, barley, corn and a number of other seeds.

The baking properties of fumigated flour and the taste and odor of bread made from it are unimpaired. The dosage of empty storerooms is 15 grams per cubic meter for 24 hours; for large-scale treatment of grain and seeds it is 50-75 grams per cubic meter. Grain in silos can be fumigated with this compound by introducing it with the stream of grain. Rats and guinea pigs tolerated daily doses of 40-50 mg. per kilogram of body weight, for 77-95 days. Bromine residues in bread baked from fumigated flour were 0.007-0.0013 mg. per gram. J. Aman, L. Farkas, and M. H. Ben-Shamai, *Ann. Applied Biol.* 33, 388-95.

•

Insecticides on Honeybees

Some of the new insecticides and one hormone weedkiller were tested for toxicity to honeybees. 2, 4-Dichlorophenoxyacetic acid (weedkiller), piperonyl cyclohexenone, xanthone, chlordane ("Velsicol 1,068"), and phenothiazine were nontoxic. Rotenone was toxic in dusts at 3.5-4 per cent concentration, and 2, 2-bis (p-methoxyphenyl) - 1, 1, 1 - trichloroethane on surfaces was toxic by contact. Cryolite, calcium arsenate, dinitro compounds, DDT, sabadilla, hexaethyl tetraphosphate, and benzene hexachloride were highly toxic to bees. Use of dinitro compounds for blossom thinning may prove a potential threat to beekeeping. DDT is much less toxic than calcium arsenate or cryolite when used as a 5 per cent dust. P. M. Eide, *J. Econ. Entomol.* 40, 49-54;

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Insecticidal Dusts

In preliminary tests, benzene hexachloride dusts as 1 per cent of the *gamma* isomer, were effective against a number of agricultural insects, but injured the germination of sweet corn, snap bean, and lima bean seeds. Chlordane in dusts was effective against corn lantern fly and fall armyworm. Piperonyl cyclohexenone proved to be an effective synergist for pyrethrum. J. W. Brooks and L. D. Anderson, *J. Econ. Entomol.* 40, 220-8.

•

Unstable Emulsions

Cationic emulsifiers are used to give insecticidal emulsions which are unstable in contact with foliage. Emulsifiers used for the purpose included trimethyl octadecyl ammonium bromide, fatty acylated nitrogen bases, triethyl hexadecyl phosphonium bromide, and ternary sulfonium salts. The instability of the insecticidal emulsions on contact with foliage was attributed to neutralization of the negative electrostatic charge normally existing on foliage. K. E. Maxwell, to Shell Development Co. U. S. Patent No. 2,418,652.

•

Control of Grasshoppers

Technical chlordane containing 60-70 per cent of active agent (1, 2, 4, 5, 6, 7, 8, 8-octachloro-4, 7-methano-3a, 4, 4, 4a-tetrahydroindane) and the balance related compounds, was tested in the field as a spray and dust against *Melanoplus femurrubrum* and *M. differentialis*. Benzene hexachloride was tested in the same way. A dosage of 8 ounces per acre of chlordane, applied as an aqueous spray, controlled nymphs of the second species, and nymphs and adults of the first species of grasshopper. Dusts were less effective than sprays; water emulsions were more effective than wettable powders. Oil solutions act slower than water emulsions and may injure foliage. Benzene hexachloride as the gamma isomer in sprays or dusts at about 0.3 pound per acre gave nearly complete control, with swift action but almost no residual effect. C. J. Weinman, G. C. Decker, and J. H. Bigger, J. E con. Entomol. 40, 91-7;

•

New Use For BHC?

An auxiliary use of benzene hexachloride may be the result of experiments at the West of Scotland Agricultural College, according to the British press. When "Gammexane" was mixed with fertilizers, the turnip flea beetle was controlled and plants were more vigorous and of better color, improvements usually associated with a more plentiful nitrogen supply. The same results were noted in trials with oats. It was tentatively concluded that the insecticide had the effect of reducing the number of harmful bacteria, and its use for partial soil sterilization will be tested.

•

Mexican Fruitfly Control

DDT emulsions containing soybean oil, corn oil, or dibutyl phthalate as solvent were more toxic to adults of the Mexican fruitfly at 25° C. than similar emulsions prepared with fish oil, diethyl phthalate, or acetone. A 10 percent DDT- pyrophyllite dust was a much more toxic contact material than DDT dissolved in either acetone or alcohol, or a suspension of DDT in alcohol and water. The toxicity of pyrophyllite dusts containing 2-10 percent of DDT decreased at concentrations below 8 percent. Only the difference between 10 percent and 2 percent was significant. No significant difference in the average mean length of life was shown between Mexican fruitflies exposed to undiluted technical DDT and those exposed to 10 percent DDT in pyrophyllite, talc, aluminum oxide, walnut-shell flour, diatomaceous earth, or sulfur. C. C. Plummer. U. S. Dept. Agr., Bur. Entomol. Plant Quarantine E-700, 14 pp. (1946).

INDUSTRY NEWS

S-W Forms New Agricultural Chemical Division

Heads of new Sherwin-Williams Agricultural Chemical Division are Donald S. Gaarder (seated, right), director; Dr. Eugene D. Witman (seated, left) director of laboratory research and development; Dr. Harold A. Waters (standing, left) supervisor of technical service and field work; and Michael L. Somerville, (standing, right) general manager in charge of production.

SHERWIN-WILLIAMS CO., Cleveland, has announced the establishment of a new Agricultural Chemical Division to handle production and sales in this growing field. Director of the new division is Donald S. Gaarder, a graduate of St. Olaf College and associated with Sherwin-Williams since 1936. Dr. Eugene D. Witman is director of laboratory research and development. He has been with the company for 11 years, and is a graduate of Ohio State University. Dr. Harold A. Waters will supervise technical service and field work. He is also a graduate of Ohio State, and has been with the firm for 12 years. Michael L. Somerville will be in charge of production. He has been with S-W for 29 years, and has had a leading part in the company's greatly increased production of insecticides. A. J. Gunderson, with S-W for 28 years, is manager of the central sales zone of the division, with headquarters in Cleveland.

The new division results from a merger of the insecticide and herbicide departments, brought about from greatly expanded operations in the farm field. M. J. Fortier, vice-president and general manager of the Sherwin-Williams Co. states that the new division will permit closer intergration of the company's research, production, sales and distribution. This will make it possible to keep abreast of the rapid changes in the agricultural chemical field and to make new developments available to farmers even more rapidly than up to now, he said. The company has been a major producer of chemicals for agricultural use for nearly 50 years, Mr. Fortier pointed out, but now it has become the world's largest manufacturer of insecticides and fungicides.

•

N. P. C. A. To Meet

The 15th Annual convention of the National Pest Control Association is scheduled for October 27, 28 and 29, at the Bellevue-Stratford Hotel, Philadelphia. Speakers at the opening day's session will include the association president, J. Harvey Sturgeon, and secretary William O. Buettner. Reports of regional vice-presidents, committee reports, and a business meeting will occupy the remainder of the morning. The afternoon will be devoted to a discussion of the future of the pest control industry. E. R. Jennings will preside.

Tuesday morning's program will include talks on fly control and a symposium on sanitation in relation to the pest control industry will be held in the afternoon. Dr. Israel Weinstein, New York City health commissioner; Robert C. Stanfill, Food and Drug Administration, Philadelphia; and Dr. R. M. Mehurin, chief of the laboratory section, meat inspection division, Bureau of Animal Industry, will speak on topics dealing with sanitation in the food industry.

Walter W. Dykstra of the U. S. Fish and Wildlife Service is to discuss recommended methods of rodent control, and Dr. James C. Munch, Munch Laboratories, Upper Darby, Pa., will speak on "Antu."

A business meeting is scheduled for Wednesday morning, but in the afternoon Prof. H. Frings, Pennsylvania State College, will discuss Ultrasonics as a possibility in pest control. Following this, Dr. Arthur L. Brody, Pioneer Exterminating Co., New York, will preside at a discussion on equipment problems, during which time Eugene J. Gerberg, Insect Control and Research Laboratory, Baltimore, and John F. Benham, executive secretary the National Sprayer and Duster Association, Chicago, will talk on equipment subjects. A banquet Wednesday evening will end the meeting.

•

Becomes Midwest Manager

American Potash & Chemical Corp. has announced the appointment of Henry L. Taylor, Jr., as manager of midwestern sales. His headquarters are at the company's Chicago office, 231 S. LaSalle St.

MGK Personnel Changes

Clay L. Schroeder, vice president and sales manager of McLaughlin Gormley King Co., Minneapolis, Minn., has resigned his position because of ill health, an announcement from the company says. Mr. Schroeder wll continue to handle the sales of aerosol pyrethrum extract for the firm, however, and will also operate his own brokerage concern which specializes in food accounts. He will represent McLaughlin Gormley King Company on its food products line in local territory.

The company has also announced the appointment of Paul D. Torpin as sales manager. He has been assistant sales director for a number of years, specializing in agricultural insecticide sales. In his new position he is in charge of all sales, with headquarters at the company's home office in Minneapolis.

•

Hukill Chemical Formed

Hukill Chemical Corp. was recently formed as a sales organization in Cleveland to handle specialized industrial chemicals and resins. President and general manager is Emory G. Hukill, Jr.; vice-president and secretary is Nelson Sharpe; and vice-president and treasurer is Walter H. Lamprecht, Jr. The new corporation is engaged in making contacts with producers of specialized industrial chemicals who desire representation in Ohio and surrounding territory.

•

Southern States Elect

A. Preston Sales, Jr., has been appointed general manager of Southern States Fertilizer Service, Richmond, Va. W. M. Campbell was named assistant manager in charge of distribution. W. T. Steele, Jr., whose position was filled by Mr. Sales, has been named director of wholesale services for the firm.

•

Forest Lands Acquired

St. Regis Paper Co. recently acquired the right to manage and utilize 208,000 acres of long leaf and slash pine in Suwannee Forest in Georgia. From this area the company expects to get 260 tons of pulp per day, which, added to a supply from adjacent territories should bring the production of bleached and unbleached sulfate pulp to 750 tons a day, according to the company.

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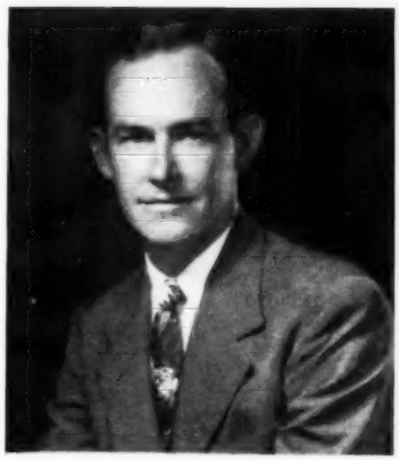
New Ass't Sales Manager



C. H. SLATER

C. H. Slater has been named assistant general sales manager of J. T. Baker Chemical Co., Phillipsburg, N. J., according to a recent announcement by the company. Mr. Slater was formerly sales manager of the fine chemical division, and will continue to devote part of his time to the management of the Fine Chemical division.

•

Amm. Nitrate Findings

Final findings on the April 16 ammonium nitrate explosion at Texas City were announced September 28 by Admiral J. F. Farley, Commandant, U. S. Coast Guard, whose Board of Investigation had been gathering details for several months. (This is not to be confused with other investigations also under way; notably the Secretary of Treasury's special interagency committee on the hazard of ammonium nitrate, nor the deliberations of the President's Conference on Fire Prevention which designated a committee to consider the fire hazards of ammonium nitrate.)

The Commandant stated that the fire was probably started by unauthorized smoking in the hold, and that it could have been extinguished in its early stages if firehoses had been used immediately upon discovery. He also stated that even if the fertilizer had been described in all shipping papers as "ammonium nitrate," the end result would have been the same.

Action recommended by the Coast Guard Board includes the use of correct descriptive shipping name for explosive and dangerous articles being transported by land; use of non-inflammable containers for packaging of ammonium nitrate fertilizers; and requiring increased emphasis on handling and stowage of dangerous articles and procedures for prevention and extinguishment of fire involving such cargoes.

Previous action taken by the Coast Guard makes a permit necessary when handling more than 500 pounds of ammonium nitrate on board vessles, and requires that such cargoes be loaded or unloaded in areas remote from populous centers, as designated by local Coast Guard representatives. Earlier, the Coast Guard required that vessels handling ammonium nitrate fertilizer must provide a fire watch and that responsible persons must acquaint themselves with existing regulations for the cleaning and preparation of cargo holds for loading.

•

Penick Establishes Grants

S. B. Penick & Co., New York, has recently announced the establishment of five research grants and the extension of a sixth. Fellowship grants for pharmacological and therapeutic studies have been made to Universities of Illinois, Wisconsin, California, Harvard University School of Medicine, and the Scripps Metabolic Clinic, La Jolla, Calif. A grant to the University of Michigan has been extended to January 1, 1948.

•

Fernald Joins Sharples

The development department of Sharples Chemicals, Inc., Philadelphia, has announced that Mason Fernald has joined its staff. Mr. Fernald was formerly in the sales division of Monsanto Chemical Co.

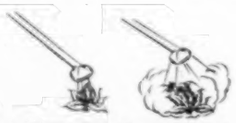
Dust deserves a chance

proper application assured with

HUDSON Stauffer KNAPSACK DUSTER

There's extra effectiveness in every pound of dust you make, sell or buy—when that dust is *properly applied.* By proper application we mean the *uniform distribution* of dust on every part of every plant—underside as well as topside of foliage. We mean the application of the *proper amount* of dust—not too much, not too little. That's the kind of effective, insect-killing, blight-resisting dusting the Hudson Stauffer Knapsack Duster gives.

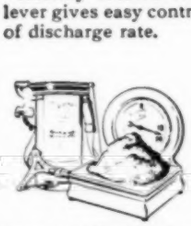
Thousands of these dusters, as perfected by Hudson, went into service during 1947 alone to give growers a new conception of efficient application. Uniform discharge of dust under perfect control at all times, economical dusting and new ease of operation is the Hudson-Stauffer combination that gives dust a chance to do its best work.



Just a puff or a blast. Ideal for spot-dusting of individual plants or fruit...equally efficient for complete coverage of plants . . . with discharge rate under perfect control always.

Easy to operate. A quick push on the handle is enough to send out clouds of dust. Conveniently located feed lever gives easy control of discharge rate.

Long-Life bellows. Made of tough, mildew-resistant Dupont material. Flexes easily, instantly for a long life of full efficiency.



Easy to fill—Giant capacity. Built-in scoop on cover makes filling easy. Duster holds 18-20 pounds of average density dust.

H. D. HUDSON MANUFACTURING CO.

Chicago, Illinois

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Gen. Shadle to Hyman

Gen. Charles S. Shadle

Julius Hyman and Co., Denver, Colo. announce that Brig. General Charles S. Shadle, CWS, will join the company as vice-president about November 1. General Shadle has had many years of chemical experience and as an administrator and organizer through his thirty year army career in which he earned a distinguished record in both World Wars. From 1923 to 1926 he organized the Third Chemical Procurement District at Pittsburgh, serving as executive officer. In 1942 he was assigned as an Assistant Military Attaché in London.

During World War II, Gen. Shadle served on Gen. Eisenhower's staff as Chief Chemical Officer in the Mediterranean Theatre. In this capacity he played an active part in the formation of policies and plans for the deployment of both British and U. S. chemical troops for the invasion of North Africa.

•

Builds Fertilizer Plant

Missouri Chemical Co., Joplin, Mo., has announced plans for construction of a 100,000 ton capacity fertilizer plant at Tulsa, Oklahoma. The new concern will be known as the Oklahoma Chemical Co. The plant will be built in conjunction with the Ozark Chemical Division of the Ozark-Mahoning Co. Two buildings are to be erected, one by the new company and the other by the Ozark-Mahoning Co. Both will be used solely for the manufacture of fertilizer.

William R. Thurston, president of Missouri Chemical, states that the plant will employ 100 workers during initial operations, and that a minimum of 50,000 tons should be produced during the first year. The output will be distributed in Oklahoma, southern Kansas, and northwest Arkansas.

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Lowdermilk Appointed

Dr. Ford R. Lowdermilk was recently appointed supervisor of the Development Division in the Research and Development Department of Pennsylvania Salt Manufacturing Co., Philadelphia. Dr. Lowdermilk was formerly associated with the Barrett Division of Allied Chemical and Dye Corp.

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Coming Meetings

Agricultural Chemicals wishes to publish the meeting date and place of any gathering concerned with manufacturing, distribution, application or discussion of chemicals for agricultural use. Information of such meetings is solicited.

Association of Economic Poisons Control Officials, Shoreham Hotel, Washington, D. C., October 19, 1947.

Association of Official Agricultural Chemists, Shoreham Hotel, Washington, D. C., October 20, 21, 22.

Association of American Fertilizer Control Officials, Shoreham Hotel, Washington, D. C., October 21.

Joint meeting of Feed Control Officials States Relations Committee, and Feed Industry's Committee on State Contacts, Shoreham Hotel, Washington, D. C., October 22.

Formal Meeting of Association of American Feed Control Officials, Shoreham Hotel, Washington, D. C., October 23 and 24.

15th Annual Convention National Pest Control Association, Bellevue-Stratford Hotel, Philadelphia, October 27, 28, 29.

Pacific Chemical Exposition October 21-25, San Francisco.

National Fertilizer Association Fall Meeting: Atlanta, Ga., Nov. 10, 11, 12.

American Association of Economic Entomologists (In conjunction with meeting of American Association for Advancement of Science.) December 26-31, Congress Hotel, Chicago, Ill.

Exposition of Chemical Industries, Grand Central Palace, New York, December 1-6.

Dr. Lulek to Heyden

Dr. Ralph N. Lulek

Heyden Chemical Corp., New York, has announced the appointment of Dr. Ralph N. Lulek as manager of its Ammonia Division. The new appointee has been research manager of Heyden since 1946, and last summer was in charge of the organization and rehabilitation of the $60,000,000 Morgantown Ordnance Works in Morgantown, W. Va., for the production of ammonia for the fertilizer program. Heyden is operating the works for the U. S. Government.

Dr. Lulek, a native of Austria, holds more than 50 patents in the field of dyes and intermediates, and is the inventor of several marketed dyestuffs. He was for 18 years with E. I. duPont de Nemours & Co. and spent a number of additional years with Publiker Industries of Philadelphia before joining Heyden.

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2,4-D Solubilizers Out

Sharples Chemicals, Inc., Philadelphia, has announced the marketing of two solubilizing agents for 2,4-D. The new products are tradenamed "Sharsol 221" and "Sharsol 193." The former has been prepared especially for the formulation of 40 percent solutions of 2,4-D, and the latter for higher concentrations. With the "Sharsol 193" 60 percent solutions can be made. These have low freezing points (—42° C.), need no thinners, and may be made without use of steam since the heat of reaction is sufficient for processing, according to the manufacturers.

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AIF Membership...

THIS issue of AGRICULTURAL CHEMICALS carries some of the highlights of the 14th annual AIF Association meeting.

Copies of other speeches, reports and discussions have been distributed to all AIF members.

These meetings continue to provide a full exchange of views between industry members, and between industry and government.

Agricultural Insecticide & Fungicide Association

285 Madison Ave. **New York 17, N. Y.**

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0,0-diethyl O-p-nitrophenyl thiophosphate[2] . . . A *promising new insecticide*

By Bruce D. Gleissner, Frank Wilcoxon, Edward H. Glass
American Cyanamid Company

IN the course of studying several thousand chemicals of various structures for insecticidal potency, the compound *O,O*-diethyl *O*-p-nitrophenyl thiophosphate[2] was found to be outstanding in its properties. This compound was designated "American Cyanamid 3422" and is referred to under that number in this paper.

"American Cyanamid 3422" proved interesting as testing proceeded, because of its very high toxicity to a wide range of insects, mites and other lower invertebrates. In general, it is more toxic as a contact insecticide than any chemical now in practical use, including nicotine, rotenone, DDT, the gamma isomer of hexachlorocyclohexane, Chlordane and related compounds, "Toxaphene," hexaethyl tetraphosphate and tetraethyl pyrophosphate. In fact, no species of insect or mite among those tested has been found resistant to its toxic action in the laboratory, at concentrations comparable to those now used for control by known insecticides.

The compound when pure, is a yellow liquid with an estimated boiling point of about 375°C. at 760 mm., a refractive index at 25°C. of about 1.5360 and specific gravity of 1.26. It is soluble in water only to the extent of 20 ppm. but is completely miscible with a wide range of esters, alcohols, ketones, ethers, aromatic and alkylated aromatic hydrocarbons. It is practically insoluble in such petroleum hydrocarbons as petroleum ether, kerosene and refined spray oils but many mutual solubilizing agents can be selected from the above classes. It is quite stable to hydrolysis in ordinary tap waters and at acid pH values, but is destroyed on short standing in alkali of pH 11 or such fungicidal mixtures as 8-8-100 Bordeaux and lime sulfur. It is compatible with wettable sulfurs and "neutral coppers" so proper combination insecticide-fungicide programs can be worked out. Safe combinations with other insecticides include DDT, hexachlorocyclohexane, rotenone, pyrethrum, lead arsenate and dusting sulfur. The insecticidal activity is not destroyed by atmospheric oxygen, nor by ultra-violet light, all of which are factors influencing the practicality of a chemical for agricultural pest control.

As a contact spray against the black bean aphid, *Aphis rumicis*, kills of between 80 and 100% are obtained in 48 hours at dilutions of 1-100,000, with even greater dilutions being effective with wetting agents such as "Vatsol OT." Dusts containing 0.05% to 0.1% give 90-100% kills in 48 hours.

Considerable residual action is evident when periodic exposures of dust films are made to the confused flour beetle, *Tribolium confusum*. While a 25 mg. dose of a 0.01% dust evenly distributed over the surface of a petri dish will give 100% kill in 24 hours, as a fresh film, when the concentration is raised to 0.25%, 100% kills are obtained for 11-12 days and a 1% dust gives very effective kills for over 25 days. This is of course in the laboratory but considerable residual action has been evident from the first field reports.

Three pests that are relatively resistant to DDT readily succumb to "American Cyanamid 3422," namely the Mexican bean beetle, greenhouse red spider and German cockroach. A 0.2% dust in the laboratory gives 100% kill of all stages of the bean beetle in 24 hours and 0.25% and 0.5% dusts have been found effective in the field. Sprays as dilute as 1-40,000 give 100% kills of greenhouse red spider and several related mites have been effectively controlled with dilutions of 1-4,000 and 1-8,000 in the field. Aerosol treatments of 0.5 gm. of "3422" per 1000 cubic feet have been very effective on this red spider in the greenhouse and in addition have controlled many other pests including aphids, thrips and mealy bugs.

A dose of 50 mg. of a 0.02% dust applied in a typical laboratory pan test has given 100% kill of the German cockroach in 24 hours. Other insects for which laboratory data have indicated a high degree of promise include southern army worm, California red scale, black carpet beetle, house fly, cucumber beetle, Japanese beetle and several species of mosquito larvae. There seems to be a wide margin of safety to plants but certain cucurbits have shown some sensitivity.

Laboratory administration to warmblooded animals has indicated the compound to be hazardous by oral administration and by topically applied solvent mixtures, but dilute dusts and wettable powder suspensions have indicated a rather wide margin of safety. The investigation of this compound is proceeding.

* Acknowledgment is made to the following members of the staff of the Stamford Research Laboratries, American Cyanamid Company, who contributed to the development of methods of synthesis of this material: J. H. Fletcher; I. Hechenbleikner; E. I. Hoegberg; J. C. Hamilton; Miss B. J. Sertl and J. T. Cassaday. Phytotoxicity experiments were performed by K. G. Nolan.

2 A less complete summary of properties of this compound appeared in B.I.O.S. Interim Investigation Report No. 22F-22/15.

An additional reference occurs in B.I.O.S. report No. 22K-15/4.

Chemical Exposition Coming

Plans are well under way for the 21st Exposition of Chemical Industries to be held at Grand Central Palace, New York, December 1 to 6. An increased number of new exhibitors is expected in addition to a large number of former exhibitors, according to reports from the committee in charge. Charles F. Roth is manager of the exposition and E. K. Stevens is associate manager.

To Canadian Position

American Cyanamid Co., New York, has placed on its staff Alexander T. Sinclair as agriculturist for Canada and the Maritime Provinces. Mr. Sinclair, a native of South Africa, was reared on a farm in western Canada, and attended the University of Alberta. He will make his headquarters at North American Cyanamid Ltd., Welland Works, Niagara Falls, Ont., Canada.

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New Cal-Spray President

Arthur W. Mohr, recently named president of California Spray-Chemical Corporation, Richmond, Calif., to succeed Harold C. Davies,

A. W. Mohr

is a native of that state and a graduate of the University of California at Berkeley. Upon graduation with a B.S. degree, Mr. Mohr worked in the laboratories of Standard Oil Company, and progressed into development work and eventually into sales management. Rather early in his Standard Oil career, he was transferred to the American Bitumuls Co., a subsidiary, where he gained broad experience in plant management and in national sales management.

The new president has a wide acquaintance of friends in the chemical field throughout the nation. He is making his home in Diablo, Calif.

•

Observes 10th Anniversary

Carolina Pyrophyllite Co., New York, is observing its tenth business anniversary during the month of October. It was in October, 1937 that the first car of ground pyrophyllite was shipped from the firm's new plant at Staley, N. C. The capacity of the plant has been increased since that time, and additional facilities have been acquired by the company. In 1944 the firm took over the mine properties and grinding mill formerly owned by the Prophyllite Talc Products Co., Glendon, N. C., which with the original facilities, turns out a considerable tonnage of pyrophyllite suited to insecticide use. In addition to this use for the product, the company produces pyrophyllite for other industries.

•

Berk Production Resumed

Production of inorganic mercurial sales was quickly resumed by the F. W. Berk Co. following a recent fire at its Wood Ridge, N. J. plant. Damaged equipment was replaced within a short time and installed in other buildings so that production was halted only temporarily. M. H. McAllister, vice president of the Berk Company points out that the story in September *Agricultural Chemicals* erred in stating that the entire Berk plant had suffered from the fire. He reports that damage was confined solely to the one department.

New Director Named

Four new directors of the A.I.F. Association were named at the final session of the recent meeting at Spring Lake. The new directors are:

Ernest Hart
president, Niagara Sprayer & Chemical Division, Food Machinery Corporation, Middleport, N. Y.

A. W. Mohr,
president of California Spray-Chemical Corporation, Richmond, Calif.

George R. Rinke
president, John Powell & Co., Inc., New York.

F. S. Washburn
manager, Agricultural Chemicals Division, American Cyanamid Co., New York.

Two former members of the board were replaced, making a net gain of two in the total number of board members. Walter S. Gavan, American Cyanamid Co., New York; and J. B. Cary of Food Machinery Corp., Richmond, California, are the retiring members. Mr. Gavan was recently retired from active participation in the field, and Mr. Cary's recent advancement to an executive position with Food Machinery Corp. removes him from the insecticide and fungicide field.

Hart in New Position

Ernest Hart, Medina, N. Y., was recently named president of the Niagara Sprayer & Chemical division of Food Machinery Corporation,

Ernest Hart

Middleport, N. Y. He was formerly vice-president and general sales manager of the division, a position now held by J. V. Vernon. Mr. Hart succeeds J. B. Cary who in June was named executive vice-president of the parent organization, and has since moved to the company headquarters at San Jose, California. Mr. Hart has been with Niagara division since his graduation from Michigan State College in 1914.

•

NAIDM Meets in Baltimore

The National Association of Insecticide and Disinfectant Manufacturers will hold its annual convention at the Lord Baltimore Hotel, Baltimore, Md., December 1, 2 and 3. Final program plans had not been completed at press time, but chairman Melvin Fuld of Fuld Bros., Baltimore, stated that most of the details would be worked out during October. Co-chairman of the program committee is Carter Parkinson of McCormick & Co., Baltimore.

Regular business sessions are scheduled for all day Monday, Dec. 1, and Tuesday morning. That afternoon will be devoted to committee meetings. Wednesday will see business sessions throughout the day, with an informal dinner and floor show in the evening.

To Feature Industry Talks

The American Association of Economic Entomologists and the American Phytopathological Society will hold their respective annual meetings in Chicago during the last week of December. The A.A.E.E. will gather at the Congress Hotel December 26-30, and the Phytopaths will meet at the Stevens Hotel, December 27-30. Both meetings will run concurrently with the American Association for the Advancement of Science.

Featuring both the entomological and the phytopathological meetings will be symposia in which representatives of the insecticide and fungicide industries are invited to discuss new materials now on the market, those due for marketing in 1948, or products still in the experimental stage. The insecticide symposium is scheduled for December 27 at the Congress, and the fungicide colloquium will be held at the Stevens on December 29. Both societies have requested their industries to designate representatives to speak at the sessions, and to give these men clearance to discuss the products in question.

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Holds First Annual Meeting

The first annual meeting of the Association of Economic Poisons Control Officials is scheduled to be held at the Shoreham Hotel, Washington, D. C., October 19. The program includes talks by Dr. J. L. St. John, Division of Chemistry, State of Washington; W. G. Reed, U. S. Department of Agriculture; Lea S. Hitchner, executive secretary of the A.I.F. Association; and H. W. Hamilton, White Tar Division, Koppers Co., Kearny, N. J. Promotion of uniform, effective legislation and definitions, will be discussed, as well as rules and law enforcement as applied to the industry. Members of the industry are invited to attend.

A luncheon also open to members of the industry, will be held at 1 p. m. At the luncheon, several pioneer enforcement officials will be called upon to say a few words. It is expected that Dr. Alvin J. Cox, former chief, Bureau of Chemistry, California state department of agriculture, and Dr. C. C. McDonnell, former chief, insecticide division, office of marketing services, U.S.D.A., will be among those honored in this manner.

•

N. F. A. In Atlanta Meeting

The Fall Convention of the National Fertilizer Association is scheduled to be held at the Atlanta Biltmore Hotel, Atlanta, Ga., November 10, 11 and 12. Although final plans had not yet been completed at press time, an association spokesman indicated that a panel discussion is scheduled to be presented by the Plant Food Research Committee of the association. Dr. H. B. Siems, Swift & Co., Chicago, is chairman of the committee. On the opening day, Monday, November 10, the Board of Directors will meet to start the convention.

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A.C.S. MEETING

(*Continued from Page 33*)

that understanding the metabolism of organic insecticides to which man and animals may be exposed, is basic for assessing the possible health hazard involved in each. In the mammalian species a part of the DDT absorbed is stored in the fat depots and another part in converted by the liver to bis-*p*-chlorophenylacetic acid which is excreted in the urine. The dimethoxy analog of DDT apparently behaves differently, however. The isomers of benzene hexachloride when absorbed are also deposited in the animal fat and in some instances the presence of the metabolite of 1,2,4-trichlorobenzene has been demonstrated in the excreta. In every instance in this series of compounds, the animal body converts at least a part of the insecticide to a more soluble metabolite which can be more easily eliminated. Information on the metabolism of "Toxaphene" and Chlordane is meager because methods for their detection in biological tissues are not yet available.

Commenting on "The Residual Action of Organic Insecticides," Elmer E. Fleck, Agricultural Research Administration, B.E.P.Q., said the residual action of non-volatile organic insecticides is governed largely by their resistance to chemical change under field conditions. Pyrethrum is most subject to chemical change through oxidation and polymerization reactions greatly accelerated by light. Rotenone has been shown to oxidize readily when in solution, and to give products ineffective as insecticides. Pure crystaline rotenone oxidizes readily when dusted and exposed to sunlight and inhibitors of this oxidation have not proven practical. However, the formation of dihydrorotenone, one of the oxidation products, is said to prolong the residual action and increase the toxicity to some insects. DDT must not be dissolved in alkaline solutions and catalysts such as iron must be avoided.

Speaking on "Hexaethyl Tetraphosphate and Tetraethyl Pyrophosphate," S. A. Hall and Martin Jacobson, Agricultural Research Administration, B.E.P.Q., explained that contrary to statements made by its German discoverers, hexaethyl tetraphosphate hydrolyzes, not to ethanol and orthophosphoric acid, but to a mixture of diethyl and monoethyl orthophosphoric acids.

Non-distillable liquid products corresponding to tetraethyl pyrophosphate were made by the Schrader and Woodstock methods and exhibited higher activity than hexaethyl tetraphosphate. The products possess similar physical properties when made by either method but show higher biological activity when made by the Schrader process.

Distillable tetraethyl pyrophosphate (essentially a pure compound) was prepared by two different methods and was also isolated from non-distillable products, including so-called hexaethyl tetraphosphate. It is 3 to 5 times as active as hexaethyl tetraphosphate and appears to be the active ingredient of all the non-distillable products described.

In a paper on "The Determination of the Gamma Isomer Content of Benzene Hexachloride," by C. V. Bowen and M. A. Pogorelskin, also of the B.E.P.Q., a cryoscopic method was presented for the determination of the gamma isomer content of mixtures of the isomers of technical benzene hexachloride. The method can be carried out with simple equipment available to any laboratory and requires only a short time. It involves only determining the depression of the freezing point of pure gamma isomer by the sample and by the same weight of alpha isomer.

A study has been made of a number of mixtures of liquified gases which might be suitable for low-pressure aerosols with gage pressures as low as 25 pounds per square inch and is reported upon in a paper entitled "Possible Propellants for use in Liquified Gas Aerosols" by R. A. Fulton, B.E.P.Q. The compounds investigated include chloro and fluoro derivatives of methane and ethane, such as methylene chloride, dichlorodifluoromethane, trichlorofluoromethane, monochlorodifluoroethane ("Genetron-100") and difluoroethane. This study includes the pressure-temperature relationship of the mixed gases together with the compatibility of the mixed gases with some of the solvents used in aerosol formulas.

Methods of preparation and comparison of the insecticidal activities of the new class of insecticides of the piperonyl cyclonene type which are unusually low in toxicity to man and animals were described in a report presented by Dr. Oscar F. Hedenburg, Mellon Institute, Pittsburgh, and Dr. Herman Wachs, Dodge & Olcott, Inc., New York.

Another paper by these same authors describes the "Insecticidal Properties of Methylenedioxyphenyl Cyclohexenones." It was pointed out that alkyl-5-(3,4-methylenedioxyphenyl)-3-cyclohexene-5-ones were prepared and were found to be of definite value where they are used without additions, but they are of main interest because of their ability to synergize the action of pyrethrins. The methylenedioxyphenyl cyclohexenones are highly toxic to insects, but share with the pyrethrins the property of being practically non-toxic to warmblooded animals (MLD: 7.5 gms. per kg.)

In addition to the papers on insecticides and fungicides, a number of speakers discussed various phases of the fertilizer industry. Abstracts of these papers will appear in November AGRICULTURAL CHEMICALS.—EDITOR.

TETRAETHYL PYROPHOSPHATE

(*Continued from Page 29*)

in preliminary tests. Glass and certain types of lacquer-lined iron containers were found to be quite satisfactory for packaging.

Information is not yet available on the corrosion in spray equipment. It would be expected, however, that the attack of the very dilute solutions used would be negligible on most materials of construction. Any possible attack by the acid products of hydrolysis would be minimized by adding the tetraethyl pyrophosphate to the spray tank after first filling with water and flushing the tank,

pump and attachments with water after use. Care should be taken in the use of any equipment to observe the effects of tetraethyl pyrophosphate solutions before assuming the resistance of the materials.

Summary

IT may be seen, then, that preliminary tests on tetraethyl pyrophosphate have been sufficiently promising to justify its further investigation as an economic poison. Field trials now under way or to be scheduled will afford the basis upon which logical conclusions may be drawn as to where and how this new insecticide may be best employed in insect control.

Since pure tetraethyl pyrophosphate will likely be too costly to employ as an agricultural insecticide, the material as supplied will probably be a technical product containing a relatively high percentage of active ingredient. This activity may then be expressed in terms of percentage equivalence to pure tetraethyl pyrophosphate as determined by bioassay or other accurate analytical methods. In this way an economical product of known activity may be supplied.

Much remains to be learned not only with regard to the effectiveness of tetraethyl pyrophosphate against various insects but about the many other phases of its use including compatibility with other insecticides and fungicides, toxicity to plants and animals and formulation as sprays and dusts. To obtain this information not only will intelligent and thorough tests be required, but adequate and informed supervision must be employed because of the high toxicity of the chemical.

To assist in gaining this careful evaluation, industry is cooperating with the interested Government, State and University experiment stations; and it may be expected that by late fall and the end of the growing season, that many of the questions outlined above will have been partially or completely answered. ★★

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FOOD STORAGE

(*Continued from Page 31*)

vides the most economical long-time protection. The treatment is simple, nonhazardous to the workman, and non-injurious to the seed . . . Most seed stocks are so low in moisture content that satisfactory protection is obtained from the use of chemically inert dusts. Many finely ground silica bearing dusts, diatomaceous earths or clays are effective at a dosage of 1 part per 1,000 by weight. Magnesium oxide or aluminum oxide with a mean particle size of 1 micron or less are excellent for this purpose at the same dosage. Finely ground silica gels are effective at a dosage of 1 part per 2,000 by weight. In emergencies finely ground dusts of local origin will probably be useful at dosages of from 1 to 0.1 percent by weight.

Poisonous dusts are frequently suggested for use in protecting seed from insect attack. Many such dusts are highly effective regardless of the moisture content of the seed. Because surplus seed stocks are used for animal feed, poisonous dusts have not been popular.

Outstanding among poisonous dusts are benzene hexachloride and DDT. The gamma isomer of the former is effective in protecting seed at a dosage of 1 part per million. Its technical grade is effective in proportion to its gamma isomer content. DDT is effective for the treatment of seed at the rate of 15 parts per million. Both of these materials are best used in combination with a carrier dust such as pyrophyllite or similar chemically inert material. The carrier, by increasing the volume, insures thorough distribution over the seed. A dust containing 3 percent of DDT is highly effective when mixed with seed at the rate of ½ ounce per bushel.

The practice of treating many types of seed with disinfectant dusts for protection against fungous diseases is now being amplified by the use of small percentages of DDT with the fungicidal dusts to insure protection against insects.

"RECENT DEVELOPMENTS IN THE CONTROL OF INSECT INFESTATIONS OF STORED WHEAT IN AUSTRALIA." (Dr. J. W. Evans, Imperial bureau of Entomology.) Treatment of Infestations is considered under two headings; bulk and bag stores:

Bulk Stores

THE use of mineral dusts to provide a protective barrier over the exposed grain surface has proved valuable. Magnesite (ground so that a fairly high percentage would pass a 200 mesh sieve) was the most reliable of the materials tested. It is applied by scattering on the surface of the grain at the rate of 35 oz. per sq. yd. No additional benefit is achieved by raking it in. While an inert dust will do much to hinder or prevent the development of an infestation it will not control one already present. Insect infestations which develop despite a dust barrier can be controlled by surface fumigation with carbon bisulfide.

While the method of insect control outlined above proved successful under the testing conditions, it might be less so against other insects and in countries with a different climatic environment.

Towards the end of the recent wheat insect investigations, laboratory experiments were made with impregnated dusts. It was found that the insecticidal properties of an "inert" mineral dust could be greatly increased by the incorporation of low concentrations of DDT or benzene hexachloride, and that 1:1,000 DDT and 1:10,000 of the latter were of comparable efficiency and would probably be the best strengths to use.

The greater toxicity of such dusts as compared with inert dusts would permit a significant reduction in dosage, hence their general use might become permissible from the health point of view.

Bag Stores

IN a series of tests carried out on wheat stacks of normal commercial height, it was found:

(1) That carbon bisulfide, distributed over the top of a stack, penetrates throughout it and gives at the base a kill at least as great as that in the upper part of the stack.

(2) That a dosage of 1 gallon of carbon bisulfide per 1,000 cu. ft. (for 24 hours) gives a complete kill of all stages of *C. oryzae* in a stack rendered airtight.

(3) The same dosage applied to a stack rendered airtight at the walls, (but not at the roof) gives a very good kill except at the top of the stack where diffusion reduces the fumigant concentration.

(4) It is not possible to fumigate an infested section of a stack by making airtight the faces of the affected portion only; the whole stack must be enclosed at the walls and fumigated.

The method outlined above has been applied commercially in Australia on a large scale and the results have been very satisfactory. There is no limit to the amount of wheat which can be fumigated as a single unit.

"PRINCIPLES OF RODENT CONTROL." (S. A. Barnett; Infestation Control, Ministry of Food, London.) The common species of rats and mice are (unlike insect pests) important as pests on farms, in stored products and as carriers of disease. A single organization for rodent control and research dealing with all three aspects is desirable in every area. Control methods found to be valuable include building and proofing, improvement of hygiene, rat destruction by poisoning and biological control by means of predators—cats, dogs mongooses, etc. The study of the behaviour of wild rats provides a basis for a rational system of control by poisoning, the speaker said. Rats tend to avoid unfamiliar objects, including food. The laying of plain bait for several days before poisoning accustoms rats to a new food in an unfamiliar place, and induces them to eat relatively large quantities, relatively quickly, when poison is added. This prebaiting is most effective when done with bait quantities much less than the maximum that the rats can eat in a night.

If a new food contains poison, sub-lethal doses are often taken in the early stages of overcoming avoidance. Rats so poisoned, and recovered, may subsequently refuse the same bait; they may even refuse a different bait containing the same poison, or a different poison in the same base. A new bait base and poison should be used for treating residual populations after a first poison treatment. Prebaiting with small quantities of plain bait, followed by poisoning, can usually be relied on to give a kill of at least 85%. shown by census.

Geigy's *New* Potato Vine Killer

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Rank vine and weed growth make digging operations difficult. Use Geigy Potato Vine and Weed Killer to overcome this problem. Add 1 gal. to 100 gals. water and apply spray at the rate of 100-150 gals. per acre. Quickly kills vines — tubers mature naturally — lessens danger of loss by early freezes. May we suggest that you investigate this new aid to potato growers. We will gladly supply complete information.

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Direct poisoning gives very erratic results.

Systematic control in a rural area reduced the number of rats to less than one in every 10 acres, and in a heavily built-up sub-tropical area the rat population was reduced to a very low level which persisted for over a year. It was pointed out that the sewers of London were largely cleared of rats by two treatments, but the population would build up again unless there are regular maintenance treatments and steps are taken to control surface infestations.

Fumigation, cyanide dusting, trapping and the use of predators have only a limited scope and value for rat control, and bacterial cultures do not seem to have any particular merit. The speaker concluded that the best method for control of rats, is the systematic use of prebaiting and poisoning with follow-up treatments employing alternative materials. Much remains to be learned about the changes of wild rodent populations when they are subject to large scale control, he said. Actually, the control of field rodents has hardly begun. Great administrative and educational problems remain to be solved.

Part II of this article will appear in the November issue of AGRICULTURAL CHEMICALS.—EDITOR

FERTILIZER SOLUTIONS

(*Continued from Page* 23)

acres of tomatoes the writer carefully checked, showed me his record of 8 tons per acre on 30 acres with dry fertilizer compared with 11 tons per acre on 20 acres using slightly less than one-half the fertilizer in solution form. These are commercial records which corroborate results that were obtained on experimental plots.

THERE are many similar instances that could be mentioned which continued interest in investigating the use of fertilizer solutions. In most instances the farmer made money by using the solutions. In some cases the profits were no greater than with dry fertilizer. In no case during ten years of personal investigation has a grower to the writer's knowledge lost money by use of solutions, provided they were used according to directions. Solutions which were too concentrated, have been seen to burn plants and retard their growth. Transplanting solutions have also been seen to reduce yields where dry fertilizer had been previously placed close to the roots of plants. There are certain precautions which must be observed. However, they are the same precautions that accompany the use of dry fertilizer. Transplanting solutions applied on top of the ground after plants are set will show no effect in the plant. Neither will an equal amount of dry fertilizer applied in a similar manner show a response.

When growers first use fertilizer solutions they expect phenomenal results and are disappointed if such results fail to materialize. Nature does not give something for nothing. We are primarily interested in getting

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more efficient returns for our fertilizer dollar and the writer feels certain that this can be accomplished by the use of fertilizer solutions. When it was first demonstrated that as good yields could be had with one fourth the amount of fertilizer in solution as were previously obtained with dry fertilizer, the industry immediately said the soil would soon be worn out. This sounded like a legitimate criticism until the rye cover crop following tomatoes was observed on the experimental plots. An application of 500 lbs. of 4-12-4 was compared in both dry and liquid form. In the same area were plots that had received 1200 pounds of 5-10-5 per acre. The yield of tomatoes (11 tons per acre) was the same where 1200 pounds of 5-10-5 were applied dry as where 500 lbs. of 4-12-4 were applied in solution. Where 500 lbs. of 4-12-4 dry were applied, the yield was 7 tons of tomatoes per acre. Where solution was applied, the yield of green fruit on the vines, when frost killed them, was equal to the ripe fruit that had been picked and the foliage was green and growing actively. Where the dry fertilizer was applied, regardless of the amount used, there were no green fruits and the vines were completely defoliated. The rye cover crop the following spring was 6" tall on all the dry fertilizer plots and knee high where the fertilizer solution was applied.

There seems to be no explanation for this. It convinced observers, however, that much can be learned about soils, fertilizers and plants by dry and solution fertilizer comparisons. On a purely theoretical basis with the results obtained one can start off on a philosophical chain of thought that can keep research workers busy for years to come.

On acid soils the 1-2-1 or 1-3-1 ratio is regarded necessary to get worth while results. There is every indication that a 1-1-1, a 1-1-2 or a 2-1-2 ratio may give better yields per pound of fertilizer used. So far there are only fragmentary data to prove this. The whole problem seems to center around the phosphate ion. It is generally assumed that only 25% recovery can be expected from dry superphosphate applied to the soil. However, when applied in solution form we seem to recover most of it. In other words as good results have been noted from a 2-1-2 mixture in solution as from a 1-2-1 mixture in the dry form. Plant analyses show that the nutrient ions exist in a 2-1-2 ratio, which agrees with the 2-1-2 solution mixture which was applied.

The use of fertilizer solutions is still in its infancy. A great deal of research is needed yet to determine the effectiveness of these solutions on limed and unlimed soils. There is every indication that as the lime content of the soil is increased, the effectiveness of the solution is also increased and that the phosphate ion functions to better advantage. The use of these solutions on different soil types requires much study. It is a field which appears to warrant much additional research and investigation.★★

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AIFA MEETING

(*Continued from Page 26*)

tested before being offered for sale, he continued, and dealers need complete information on new materials at the beginning of the season in order to forward such knowledge to their customers. He warned against any misguidance of dealers, saying that their operating margin is too small to tolerate losses of materials through lack of knowledge or inadequate instructions for use.

A question-and-answer session followed, with the forum participants discussing queries from the floor. In talking on industry's responsibility in stocking materials for unusual infestations, Mr. Stoddard observed that it is impossible to divert large stocks of materials from other industries because of their specificity, therefore adequate inventories are necessary.

Mr. Hart interjected to say that the industry has always been able to provide materials when needed and that there is already a good supply of some materials for 1948.

Other questions regarded the A.I.F. Association's interest in backing the new Federal law. Mr. Hitchner remarked that the new law was badly needed, and warranted the cooperation of industry. S. A. Rohwer, assistant chief of the B.E.P.Q. reiterated the necessity for industry cooperation, particularly in view of the many new fields of insecticide application and the many new materials coming into use. Uniform State and Federal laws are a necessity to avoid hit-or-miss legislation all over the country. The effect of the new laws will be to aid the farmer, he said, through enforcing adequate labeling and ample instructions.

A discussion arose regarding the policy of industry toward research on new products. Mr. Stoddard said that many promising products are right now in laboratories awaiting thorough investigation, and he emphasized the necessity of thorough testing by the producer before asking the State experiment station to take over further investigations. Since products are coming out of laboratories so fast that it is physically impossible to try them all, only the most promising can be singled out for trial.

Dr. L. Gordon Utter of Phelps-Dodge Refining Corp., New York, added that the responsibility for testing lies with industry. There is a tendency, he said, for the experiment station to dislike screening so many new products. There are simply too many for the State laboratories to handle.

Other discussions centered around Association activities, and the manner in which the group is helpful to individual members.

The meeting then adjourned for the day, with a golf tournament in the afternoon, and the annual dinner for members, ladies and guests in the hotel dining room in the evening.

Thursday's session was called to order by Association president

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Leonard who asked Mr. Stoddard for the annual report of the Membership and Information Committee. Following this report, Maurice H. Lockwood, president of the National Fertilizer Association spoke to the group, discussing the relationships of agriculture, Government and Industry. He pointed out that one of the first responsibilities of groups such as the A.I.F.A. and the fertilizer Associations is to present facts to agriculture, to government and to the public. Following the war, he related, there was an effort to enact legislation which would put the government into fields of commercial volume production and distribution of fertilizers in competition with private enterprise. To counteract propaganda favoring such legislation the fertilizer industry presented to government officials, to members of Congress, to agricultural workers, teachers, other industries and the public, facts about its production record, and its plans for the future.

"Our industry had a record of which it could be proud," he said, and added that although the eventual outcome is not yet clear, so far legislation which would put the government into direct competition with commercial fertilizer manufacturers has not been enacted. Some segments of agriculture have been persuaded to join the opposition to such a socialistic trend, many Congressmen now oppose the measure, and a movement appears to be under way for a revision of the proposed bill to eliminate much of the threat of Government competition.

The N.F.A. president stressed that all such action must be backed up by personal participation of industry unit representatives, as well as by Association staff members. Results of relationships among agriculture, Government and industry are netting much mutual good since there are many common interests in which group relationships may be improved by better understanding. None of these three, he concluded, need give up its sound sphere of influence if each warrants and shares the high regard of the others.

Harry A. Babcock, attorney in the office of Legal Investigations, Federal Trade Commission, described the function of the FTC, analyzed the obligations of the seller, and discussed other features of the Robinson-Patman Amendment to Section 2 of the Clayton Act. He also described the cooperation being carried on between the FTC and the U. S. Department of Agriculture in enforcement of the new Federal Insecticide, Fungicide and Rodenticide Act.

John A. Bird, associate editor of *Country Gentleman* presented the final paper of the meeting. He told the group that the most outstanding advancement in agriculture today is in the field of technology . . . it being largely responsible for heavy production of foodstuffs. This includes control of insects and plant diseases, freeing livestock of parasites which lower meat production, and finding improved means of soil fertilization.

These new developments in the scientific field must be interpreted

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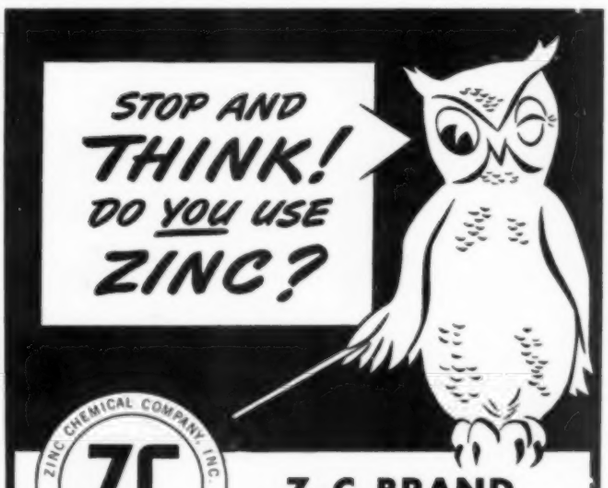

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to farmers in order for them to understand, he said. There is a great gap between the knowledge of research scientists and those who use the products. As an example, he cited that corn can be made to yield some 200 bushels per acre, yet the average yield for the nation is less than a fourth of that figure. This shows a distinct neglect in using the technological knowledge already available, he said.★★

FERTILIZER FUTURE

(*Continued from Page 51*)

have not reached the heights they did 25 years ago.

The greatest potential danger faced by the fertilizer industry is always a major slump in the price of farm produce, he declared. Growers are sufficiently "sold" on the use of fertilizer materials as a necessity, so that they will use all they can buy within reason. Thus the economics of farm income plays a vital part in the annual fertilizer tonnage in use. As to how far production will go before reaching its ultimate limit, Mr. MacDowell stated that the industry will eventually strike an economic base on farm income and the necessity of rebuilding worn-out soil. Until that leveling-off time comes, production is likely to continue its upward sweep.

In this regard, Mr. MacDowell pointed out another factor which will ease the farmer's plight in the event of a price recession. It is the relatively secure economic position of the agriculturalist of today as compared to his counterpart of twenty-five years ago. The crash of 1929 caught most farmers mortgaged to the limit, and "only a few got through with their tail feathers," as Mr. MacDowell put it. Some farmers of today have paid high prices for land, but it is not heavily mortgaged. Also, the attitude toward commercial fertilizer is completely changed on the part of most growers. Where a quarter-century ago the application of farm manure was considered to be ample in a haphazard sort of way, the modern farmer has the backing of tremendous amounts of technical research in soil nutrition so that when the recommended plant food is applied in proper amounts, he *knows* that the results will be as desired. The application of fertilizer on the farm has moved out of the hit-or-miss, almost superstitious guesswork of the past, into a well-intergrated and exact science. Consequently, most farmers are thoroughly sold and will continue to purchase and use as large quantities of fertilizer materials as possible.

This education of the farmer is being brought about from many sides. Many farm boys and girls belonging to organizations such as 4-H clubs have been thoroughly sold on the application of commercial fertilizers, and their enthusiasm is carried over to the older folks who make up today's market.

Commenting upon the recently proposed National Soil Fertility Bill which would have carried out an educational and demonstration pro-

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gram on 2 per cent of the nation's farms, the former N. F. A. president stated that there is already duplication in agricultural and scientific research, and that it would scarcely seem necessary to spend millions to build up a further duplicaton of what the independent fertilizer industry and the agricultural Experiment Stations have done and continue to do so well. Many of the proposals included in the embodied processes already known to the industry. Government research in such a setup "might hit on a good idea," but he pointed out that the private enterprise system has also evolved worthy production methods. As to the future, he said that although S. 1251 (the soil fertility bill) has failed to pass, the general threat of Government competition is still very much alive, and is likely to show itself in a number of ways. The outstanding production record of the fertilizer industry is its best argument against the entrance of Government-owned plants into production on the competitive market.★★

COMMENTS

(*Continued from Page 43*)

There are certain publications in the field, such as *Agricultural Chemicals* making a definite contribution in the dissemination of knowledge in materials new and old. Through these mediums, manufacturers and suppliers of many materials and services present straightforward information in their advertising copy. These presentations are not overenthusiastic nor exaggerated, but restrained and truly informative. Contrast these with many advertisements of years gone by! Exaggeration and misleading statements which could not stand up under close scrutiny were not uncommon in those days!

Our agricultural chemical laws no longer permit the old legal doctrine of *caveat emptor* (let the buyer beware) which imposes upon the buyer complete responsibility for protecting himself. Now, if one sells a morning glory killer for use in an orchard or vineyard, he is held responsible for warning of any hazard to the trees or vines as well as hazard to the man using the chemical. Any caution with respect to any crop should be made known. Years ago a product to be put on the backs of chickens for removing lice was presented to an agriculture chemicals district inspector of California. He left it on his desk and the next morning the varnish was neatly removed. Our various state and federal laws today are designed to prevent such products from reaching the market. Their principal purpose is to protect the uninformed buyer and user from being victimized or injured by ignorant or unscrupulous persons who set themselves up as manufacturers.

Present-day manufacturers are cooperating and working with law-enforcement agencies and there is outstanding reciprocation. The administration officers have a job to do, and the industries should work with them and see that it is done properly.

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Mul-si-mo, we believe, is the cheapest and most economical Emulsifier on the market for the emulsification of the oils above specified.

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Industry Patents

The following patents have recently been issued by the U.S. Patent Office on products and devices in the agricultural chemical field. Copies of the patents may be obtained at 25c each by addressing the U.S. Patent Office, Washington 25, D.C.

2,424,220. Insecticide containing an amyl imide of 3,6-endomethylene-4-cyclohexene-1,4-dicarboxylic acid. Patent issued July 22, to E. W. Bousquet, Wilmington, Del., assignor to E. I. duPont de Nemours, & Co., Inc. A fly spray composition containing pyrethrum and an amyl imide of 3,6-endomethylene-4-cyclohexene-1,2-dicarboxylic acid dissolved in a fly spray base hydrocarbon solvent, the amount of said imide being at least equal to 10(100X-P) mgs. per 100 cc. where P=mgs. pyrethrum per 100 cc., and is at least 5, and X=the volume ratio of fly spray to concentrate=at least 1/1.

2,424,520. Soil Improving Method. Patent issued July 22 to Charles J. Tomkin, Oakland, Calif., assignor to Shell Development Co., San Francisco. A method of treating soil to improve its plant growing properties comprising introducing approximately simultaneously into acid soil substantially below the surface thereof both a halogenated lower hydrocarbon soil fumigant and a quickly assimilable nitrogen-containing plant food.

2,424,860. Insecticidal Compositions. Patent issued July 29 to Alva V. Snider, Richmond, and John L. Van Winkle, Berkeley, Calif., assignors to Shell Development Co., San Francisco. An insecticidal composition comprising a mineral oil and a compound selected from the group consisting of unsaturated and saturated aliphatic and alicyclic monooxime esters of aliphatic carboxylic acids.

2,425,185. Insecticidal Composition. Patent issued Aug. 5, to Vernon E. Haury, El Cerrito, Calif., assignor to Shell Development Co., San Francisco. An insecticidal composition comprising pyrethrum and an N-cyclo-substituted cyclo-oletinic imine having the imino nitrogen atom linked between two ring carbon atoms.

2,425,530. Insecticide. Patent issued August 2, to Edward Harvill, Yonkers, N. Y., assignor to Boyce-Thompson Institute for Plant Research, Inc., Yonkers. A contact insecticidal composition comprising piperine and pyrethrin in a liquid spray base of petroleum origin.

2,425,677. Fungicidal Compositions. Patent issued August 12, to Wilbie S. Hinegardner, Niagara Falls, and Norman D. Scott, Sanborn, N. Y., assignors to E. I, duPont de Nemours & Co., Inc., Wilmington, Del. A fungicidal composition comprising a mixture of paraformaldehyde and sym.-trichloroaniline. The method for preventing growth of fungi in an enclosed space which comprises simultaneously introducing into said space vapors of formaldehyde and sym.-tricholoroaniline.

2,425,678. Fungicidal Compositions. Patent issued August 12, to Wilbie S. Hinegardner, Niagara Falls and Joseph F. Walker, Lewiston, N. Y., assignors to E. I. duPont de Nemours & Co., Inc., Wilmington, Del. A fungicidal composition comprising a mixture of paraformaldehyde and a dihydronaphthalene. The method for preventing growth of fungi in an enclosed space which comprises simultaneously introducing into said space vapor of formaldehyde and 1,4-dihydronaphthalene in such proportion that the formaldehyde vapor constitutes from 50 percent to about 85 percent by weight the combined vapors.

Trade Mark Applications

LAUXIDE, in capital letters, for insecticide in powdered and liquid form. I. D. Laucks, Inc., Seattle, Washington, assignor to Monsanto Chemical Co. Claims use since Jan. 19, 1945.

DE-PESTER, in capital letters, the top forming an arc, for insecticide. Southwestern DDT Corporation, Dallas, Tex. Claims use since Dec. 1, 1945.

SPRITZ, in outline capital letters, slanting upward to the right, for insecticides. Monarch Chemical Co., New Orleans, La. Claims use since Oct. 8, 1945.

P-40, in black letters, for insecticide containing compounds useful as a fertilizer. Plant Products Corporation, Blue Point, N. Y. Claims use since Feb. 23, 1945.

PENNSALT, in thick capital letters, with stem of "P" extending below other letters. For insecticides. Pennsylvania Salt Mfg. Company, Philadelphia. Claims use since Apr. 22, 1946.

KNOX-OUT, in heavy script letters, caps and lower case, for herbicides. Pennsylvania Salt Mfg. Co., Philadelphia. Claims use since Aug. 5, 1946.

TYON, in stencil capital letters, for hormone spray containing naphthalene-acetic acid for preventing fruit from dropping before maturity. Oil Sprays, Inc., also doing business as Crop King Co., Yakima, Wash. Claims use since August, 1945.

HETP, in capital letters, for chemical products for use in combatting insects, mites and other plant pests in the agricultural field. Monsanto Chemical Co., St. Louis, Mo. Claims use since Nov. 26, 1946.

KRENITE, in capital letters, for chemical compounds used as horticultural sprays. E. I. duPont de Nemours & Co., Wilmington, Del. Claims use since Feb. 21, 1945.

CHEMI-TROLL, in capitals, with first letter of each word extra bold, for insecticides, fungicides and herbicides. Chemi-Troll Products, Gibsonburg, Ohio. Claims use since Jan. 15, 1946.

DIVOBAN, in capital letters, for insecticide. The Diversey Corp., Chicago. Claims use since Nov. 26, 1946.

SUPERTONE, in capital letters, for parasiticides. California Spray-

Chemical Corp., Richmond, Calif. Claims use since Nov. 27, 1946.

KRY-O-CIDE C, in caps and lower case, with the extra "C" in a box beneath the word. For insecticides. Pennsylvania Salt Mfg. Co., Philadelphia. Claims use since Feb. 20, 1945.

RAT-TROL, in script capital letters, for rodenticide. Thompson-Hayward Chemical Co., Kansas City, Mo. Claims use since Sept. 19, 1946.

SEEDOX, in capital letters, for fungicide. Givaudan-Delawanna, Inc., New York. Claims use since Dec. 5, 1946.

BHC, in tall capital letters, for insecticidal composition for use on plants and animals. Food Machinery Corporation, San Jose, Calif. Claims use since Oct. 17, 1946.

HET, in tall capital letters, for liquid chemical composition used as agricultural insecticide for control of aphids and mites. Michigan Chemical Corp., St. Louis, Mich. Claims use since Jan. 10, 1947.

NIRAN, in letter-spaced sans serif capitals, for chemical toxicants for use as agricultural insecticides, fungicides and herbicides. Monsanto Chemical Co., St. Louis, Mo. Claims use since Feb. 7, 1947.

RIDGELIZER, in small capital letters, for fertilizers. James G. Clark, doing business as Ridgeway Fertilizer Co., Lakehurst, N. J. Claims use since Aug. 1, 1946.

OLD TRAPPER RAT KRUNCHES, in circle, with first two words, in old style lettering, accompanied by figure of man with gun. For rodenticides. J. A. Stanley, (Stanley Industries), Seattle, Washington. Claims use since Jan. 2, 1940.

MCP, white letters, within black octagon, for insecticides. Mill Creek Products, Kansas City, Mo. Claims use since May 29, 1945.

BIOQUIN, in sans serif capital letters, for chemical products for use as agricultural insecticides, fungicides and herbicides. Monsanto Chemical Co., St. Louis, Mo. Claims use since Feb. 7, 1947.

SABANE, in heavy capital letters, for insecticide. Woolfolk Chemical Works, Ltd., Fort Valley, Ga. Claims use since October, 1946.

STEROX, in light sans serif capitals, for chemical products used as insecticides, fungicides, herbicides and rodenticides, Monsanto Chemical Co., St. Louis, Mo. Claims use since about Feb. 24, 1947.

BAITU, in heavy capital and lower case, for rodenticide, Arthur Beck Co., Chicago, Ill. Claims use since Mar. 24, 1947.

OCTA-KLOR, in stencil capital letters, for insecticides. Julius Hyman & Co., Denver, Colorado. Claims use since March 15, 1947.

DRICONURE, drawn in diamond shape in connection with vertical motif showing farm produce and farmhouse, for fertilizer. Atkins & Durbrow, Inc., New York. Claims use since January, 1946.

LION, incorporated with picture of lion beneath arc of circle. For fertilizers. Lion Oil Co., El Dorado, Ark. Claims use since Sept. 3, 1946.

AEROPRILLS, in light capital letters, for ammonium nitrate for fertilizing purposes. American Cyanamid Co., New York, N. Y.

Trade Mark Applications Granted

431,438. Fertilizers. Filed June 28, 1946, by California Spray-Chemical Corp., Richmond, Calif.

431,608. Multi-wall paper bags. Filed April 22, 1947, by Bagpak, Inc., New York.

431,810 and 431,811. Insecticides used for spraying plants. Filed May 25, 1945 by Plant Products Co., Blue Point, N. Y.

431,826. Germicides and Fungicides. Filed Dec. 15, 1945, by Harry L. Goldwag, doing business as Goldicide Laboratories, New York.

431,837 and 431,838. Insecticides. Filed Feb. 5, 1946, by E. John Kennedy, New York.

431,866. Parasiticides, namely, insecticides, fungicides, germicides and herbicides. Filed Apr. 16, 1946, by Calif. Spray-Chemical Corp., Richmond, Calif.

431,913. Insecticides. Filed June 17, 1946, by Farmcraft, Inc., Portland, Ore.

Announcing

Eston HETP

HEXAETHYL TETRAPHOSPHATE

The amazing new insecticide for control of Aphids, Spider Mites and many other insects.

NOW AVAILABLE IN QUANTITY

BIOLOGICALLY TESTED ... Each drum checked before shipment.

HIGHER TOXICITY because of new manufacturing process.

TECHNICAL ASSISTANCE for processors and users.

ALSO AVAILABLE:

HEXON 50 and 90. A 50% and 90% solution of Hexaethyl Tetraphosphate with suitable solvent and wetting agent. Write or wire today for full price and technical information.

OTHER Eston CHEMICALS insecticides... soil and space fumigants... refrigerants.

The West looks to Eston for chemicals

Eston CHEMICALS, INC.

3100 East 26th Street
Los Angeles 23, California

Classified Advertising

Rates for classified advertisements are ten cents per word, $2.00 minimum, except those of individuals seeking employment, where the rate is five cents per word, $1.00 minimum. Address all replies to Classified Advertisements with Box Number, care of AGRICULTURAL CHEMICALS, 254 W. 31st St., New York 1. Closing date: 1st of month.

Positions Open

Entomologist Wanted: Young man with pleasing personality, entomological training wanted by established firm in sales work. Location on south east-coast of Florida in winter and eastern seaboard in summer. Give full record, salary expected. Address Box 183 care of Agricultural Chemicals.

Plant Pathologist Wanted: Plant pathologist by progressive insecticide and fungicide firm for sales development. Firm also manufactures complete line of commercial fertilizers. Plant located in Northern Ohio. Address Box 184 care of Agricultural Chemicals.

Supt. Wanted: Plant superintendent to operate commercial fertilizer and insecticide plant, located in Northern Ohio. Old established concern and unusual opportunities. Address Box 185 care of Agricultural Chemicals.

Graduate Fellowship Open in insecticide chemistry. Desire entomologist interested in working for Ph.D. in agricultural chemistry: ten semester credits allowed, stipend $1200. Give full educational record. Address Box 186 care of Agricultural Chemicals.

Pathologist Wanted: Young man with a Master's Degree in Pathology. Age 25 to 35. Ohio Territory. A splendid opportunity for man selected. Address A. F. Arheit, P.O. Box 790, Sandusky, Ohio.

Positions Wanted

Sales Executive: Technical service and sales development executive, twenty years experience with leading firms selling to the agricultural chemical field—seeks new connection. Prefer position with substantial amount of outside contact work, requiring thorough acquaintance with technical background of the industry. Location in New York or Philadelphia area preferred. Address Box 181 care of Agricultural Chemicals.

Production Specialist: M.Sc. in vegetable crops, experience in vegetable growing and related problems, insecticides, fungicides, general farm and personnel management. Desires position with progressive organization or large grower. Address Box 182 care of Agricultural Chemicals.

Entomologist: Specialist in mosquito control with worldwide experience covering 20 years, both civilian and military, desires new connection preferably with insecticide manufacturer. Experience also in large-scale control of rodents, roaches, fleas, bedbugs, etc. on ships, hotels, camps, etc. Extensive knowledge new insecticides, new equipment, and methods. For further details write to Box 188 care of Agricultural Chemicals.

Chemist: Two years experience in various types of insecticide analysis. Desires new position with good future opportunity on eastern seaboard, preferably in metropolitan area. For full record, address Box No. 191, care of Agricultural Chemicals.

Entomologist: Mature, successful experience in research, plot testing, lab'y, methods, rearing. Seeks responsible position in bioento field. Insecticides, herbicides. Will travel. Present employment has insufficient outlet. Address Box 194 c/o Agricultural Chemicals.

Wanted: Established sales agencies covering jobbers, supply houses, etc., for exclusive territories to sell old, established line of chemical specialties, industrial paints, roof coatings, etc. This manufacturer 50 years in business sells only to the trade. No sales to consumers. Full reference exchange. If interested, write to Box No. 190, Agricultural Chemicals.

Used Equipment: Full line of used and rebuilt grinders, mixers, screens, kettles, tanks, pumps, filling machines, etc. Send for our latest catalog. We also buy your surplus equipment. Stein Equipment Co., 90 West St., New York 6, N. Y.

ALVIN J. COX, Ph.D.
Chemical Engineer and Chemist
(Formerly Director of Science, Government of the Philippine Islands; Retired Chief, Bureau of Chemistry, State of California, Department of Agriculture.)
ADVISOR ON AGRICULTURAL CHEMICAL PROBLEMS AND INVESTIGATIONS
Consultant in reference to spray injury and damage, claims, including imports of fruits and nuts, formulas, labeling, advertising and compliance with law.
1118 Emerson Street
Palo Alto, California

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". . . but, what if No Trust don't win? Who pays me?"

Long shots!

LONG shot advertising is like long shot betting,—once in a while you win, but mostly you don't. In advertising products for business and industry, the smaller circulation, short-priced space in the business press usually pays off. Concentrated and specialized circulation, deeper reader interest,—these are only two of the reasons.

If you would consider a sure thing to reach the agricultural pesticide field through advertising in an active, closely-read business publication blanketing this market, we suggest investigating

AGRICULTURAL CHEMICALS

254 WEST 31st STREET **NEW YORK 1**

TALE ENDS

S. B. Penick & Co., New York, is the subject of an article in the *Saturday Evening Post* of October 11. The author is J. D. Ratcliff, who entitles his work "Sandalwood to Ant Eggs," describing the firm's worldwide search for various raw materials, for insecticide and perfume bases, fixatives and essential oils. The history and growth of the company related, and the organization's outlets for finished goods are discussed.

•

Flower Foods, Inc., Maywood, Ill., displayed at the convention of the Florists Telegraph Delivery Association in Chicago, last month, a chemical compound, "Bloomlife," described as a cut flower food for prolonging life, brilliance and fragrance of cut flowers. On the market since 1938, the product is used by retail florists in their shops, while many of them also present small packets of the compound to customers with instructions to dissolve the powder in water and use in vases holding their purchases.

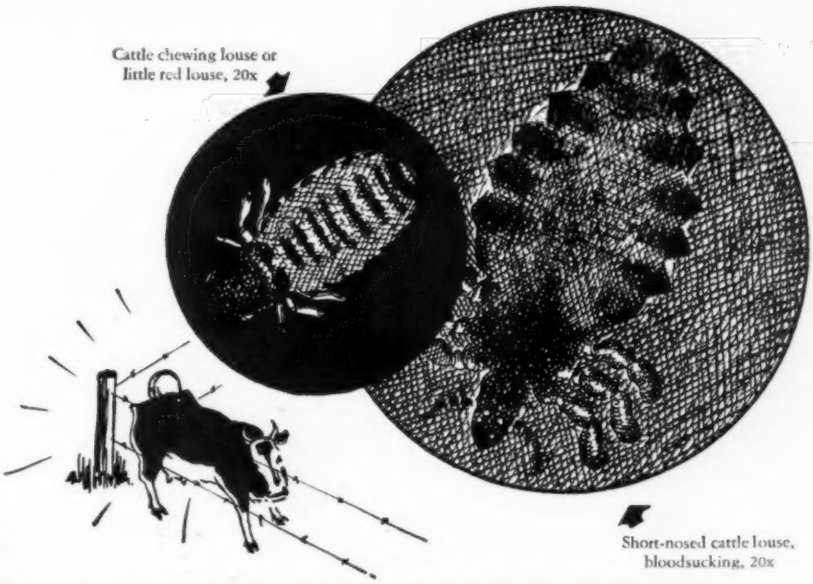
•

Chas. A. Martin Co., Des Moines 9, Ia., has placed on the market a new weed gun for use with the "Martin Hi-Potency" 2,4-D weed killer. By placing the point of the gun on the crown of a weed an accurately metered amount of the chemical is discharged. As the handle is raised the gun reloads automatically. Fully loaded, the device weighs about 5 lbs. With each purchase a 2 oz. bottle of the Martin weed killer is given, this being sufficient, it is claimed, for 15 to 20 loads, or enough to kill 10,000 dandelions.

•

From the southern manager for one of the largest agricultural chemical firms in the country, we recently received the following comment: "Allow me to congratulate you on being the first magazine which has ever hit the spot. I say this after reading junk for twenty years." After reading this, three buttons popped off our vest. But, boy, it sure "hit the spot" with us too!

PRINTED BY WATKINS PRINTING CO., BALTIMORE



CATTLE LICE

(Bovicola bovis—chewing louse)
(Haematopinus—bloodsucking louse)

BUG OF THE MONTH

. . . controlled with Benzene Hexachloride

LARGE scale tests, both laboratory and field, show that Benzene Hexachloride is a very effective material for the control of all species of lice on livestock. Since BHC kills lice and eggs at the same time, complete eradication of lice is possible with one treatment, if every animal in the herd is thoroughly treated.

Here is a marketing opportunity for the off-season. Lice are most abundant during the winter, hatching in from one to two weeks, and reaching egg-laying adulthood in another two weeks. Consequently they usually increase tremendously during the winter and early spring if not thoroughly controlled.

Benzene Hexachloride is the only material so far developed that will kill both lice and eggs, when properly prepared and formulated. Prentox BHC Powder, containing 7½% of the active gamma isomer dispersed in carriers of the proper particle size range, is an ideal starting point for such formulation. It can be blended in simple dust-mixing equipment, and offers a winter-season specialty with sure-fire sales appeal.

Write for further information on this profitable new development.

Complete control with BHC Promises greater milk production.

R. J. PRENTISS & CO., Inc.

110 WILLIAM STREET, NEW YORK 7, N. Y. 9 SO. CLINTON STREET, CHICAGO 6, ILL.

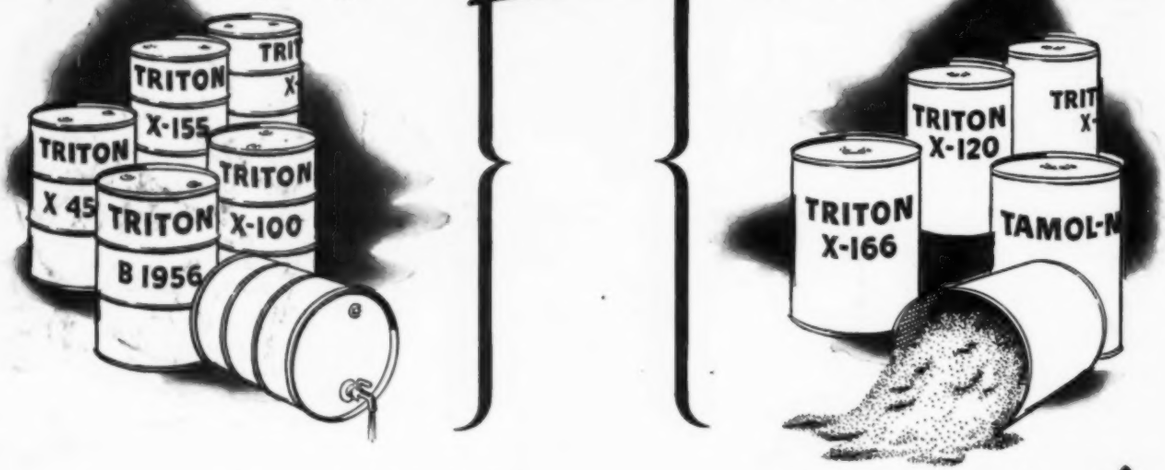
PRENTOX PEST-TESTED CONCENTRATES SOLD TO INSECTICIDE MANUFACTURERS ONLY

DDT CONCENTRATES • SABADILLA DUST CONCENTRATE • PYRETHRUM PRODUCTS • CHLORDANE CONCENTRATES • CUBÉ POWDER

For more dependable insecticide sprays

OR

For more efficient insecticide powders



TRY THE TRITONS!

Insecticides and fungicides containing these time-tried emulsifying, wetting and spreading agents have proved themselves superior. TRITON X-100 is included by many U. S. Government agencies in specifications for emulsion concentrates. Whether your formulation is a liquid or a powder, you will find a TRITON to fit your needs. Our research facilities offer fullest cooperation in new developments or data gathered from the widespread use of the TRITONS.

Tritons for use in insecticides and fungicides

FOR LIQUID PRODUCTS

TRITON X-100: High in preference as emulsifier in DDT mosquito larvicides, agricultural sprays and other emulsion type products. Recognized for stability and wetting properties—inexpensive to use. Ideal for formulations of hexaethyl tetraphosphate.

TRITON X-155: Especially developed for use in DDT solvent solutions. An economical emulsifier yet dependable in use with all types of water.

TRITON X-45: An emulsifier for use in oil type agricultural sprays. It is more soluble in oil and less soluble in water than TRITON X-100.

TRITON B-1956: Widely used spreader, depositing agent and emulsifier for oil-base mosquito larvicides, dormant sprays and other oil sprays for fruits and vegetables.

FOR POWDER PRODUCTS

TRITON X-120: A carefully developed wetting agent, especially designed for the powder-type products such as DDT wettable powders. Products containing TRITON X-120 are free-flowing, easily wet and readily suspendable.

TRITON X-166: A wetting, conditioning and dispersing agent for use in the manufacture of dry insecticides and fungicides such as wettable sulfur.

TAMOL N: A conditioner and dispersing agent for use with TRITON wetting agents to furnish ultra-smooth wettable powder products with outstanding suspendability. TAMOL N in conjunction with TRITON X-120 is used in the most efficient DDT wettable powders.

Other TRITONS, *not listed here, are used in a wide variety of industrial and household applications.*

TRITON *and* TAMOL *are trade-marks, Reg. U.S. Pat. Off.*

Canadian Distributor: P. N. Soden & Co., Ltd., Montreal and Toronto. Represented by Cia. Rohm y Haas, S.R.L., Carlos Pellegrini 331, Buenos Aires, Argentina, and agents in principal South American cities

ROHM & HAAS COMPANY

WASHINGTON SQUARE, PHILADELPHIA 5, PA.

Manufacturers of Chemicals including Plastics • Synthetic Insecticides • Fungicides • Enzymes • Detergents
Germicides • Chemicals for the Leather, Textile, Ceramic, Rubber, Paper, Petroleum and other Industries